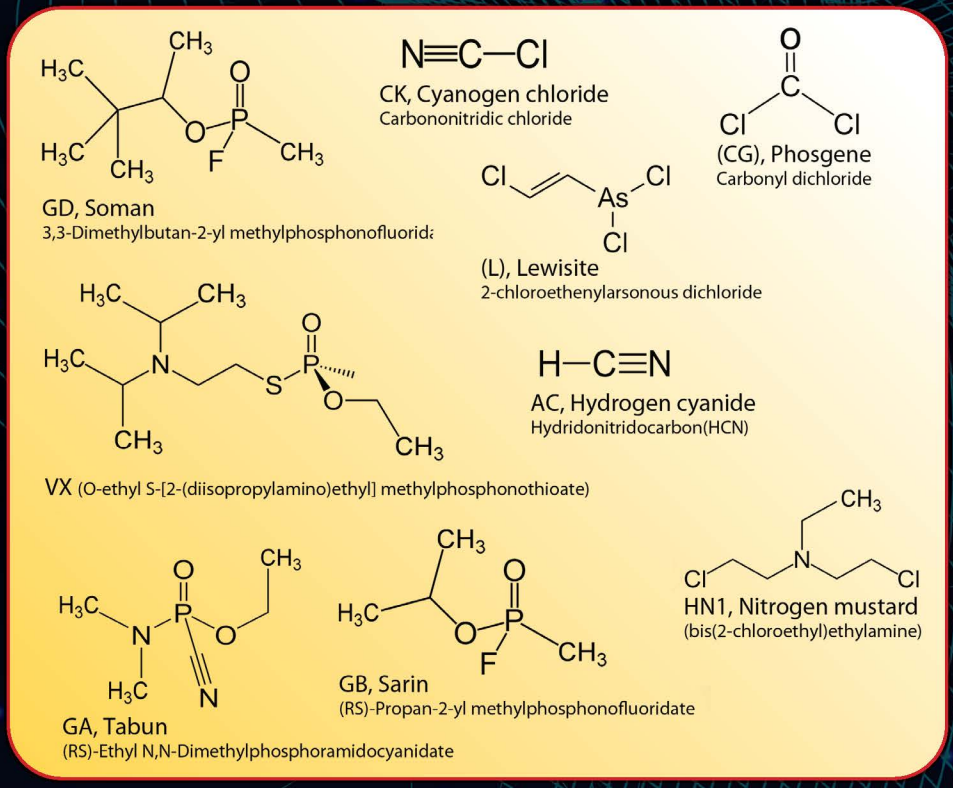
THIRD EDITION

Handbook of Chemical and Biological Warfare Agents

VOLUME 1

Military Chemical and Toxic Industrial Agents



D. Hank Ellison

CRC Press
Taylor & Francis Group

Handbook of Chemical and Biological Warfare Agents, Volume 1



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Chapter 13 Irritating/Lachrymatory Agents
Chapter 14 Vomiting/Sternatory Agents
Chapter 15 Malodorants
Chapter 16 Toxins
Chapter 17 Bacterial Pathogens
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A Agent delivery
B Summary of military chemical munitions markings
C Biological risk groups and biosafety levels
D International and U.S. domestic lists of agents

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Preface to Volume 1

The first edition of this handbook was written in 1999. At that time, it was one of only a few resources available to the general public that addressed chemical and biological warfare agents in detail. This is no longer the case. There are numerous books and papers that have been written on virtually all aspect of these agents. Some are written for the average citizen while others are specialized and directed toward a specific audience. Some are broad sweeping overviews with minimal technical data, while others focus on topics such as toxicology, medical treatment, and threat scenarios.

This handbook was originally written as an aid to first responders and meant to help bridge the gap between what was known about responding to industrial hazardous materials, and responding to events involving military chemical and biological agents. It was formatted to resemble two classic resources recognized by virtually every responder working at a hazardous material incident: The NIOSH Pocket Guide and the transportation Emergency Response Guidebook. This structure gives rapid access to key information need by responders early in a response without overwhelming them with inessential details. The second edition underwent a consolidation of information along with a change in format that made it more succinct. The number of agents identified was also greatly expanded.

This new edition retains the formatting changes made in the second edition. However, there have been some changes in the identification of agent classes. In this current edition, two of the classes from the second edition, bacterial and rickettsial pathogens, have been consolidated into a single class in order to provide clarity and reflect current scientific taxonomy. Two new classes of biological agents, bioregulators and non-vector entomological agents, have been added. The information presented in every class detailed in this edition has been updated and expanded. There is also a significant increase in the number of agents described, as well as in the number of components, precursors and decomposition products. Individual entries contain more information on health effects, and on the chemical, physical and biological properties of individual agents.

This volume also includes changes that correct the structure of the Novichok agents that was misidentified in the second edition as having an oxime moiety. The oxime series has been retained as a separate subclass, as those agents were also investigated for their possible utility as warfare agents.

The body of information in this new edition of the handbook exceeds a size that can comfortably be handled in a single volume. Volume one of this edition contains those classes of military chemical agents that were developed for their lethal effects as well as toxic industrial agents of concern. Volume two contains chemicals that were developed as incapacitating agents or for use in riot control situations, as well as all classes of biological pathogens and mid-spectrum agents. No value or utility of the agents is implied in this grouping nor in the sequence that the classes are presented in either volume.

All materials listed in this handbook have been used on the battlefield, stockpiled as weapons, received significant interest by research programs, used or threatened to be used by terrorists, or have been assessed by qualified law enforcement and response organizations as agents of significant concern. In presenting this broad spectrum, I do not offer an evaluation of the efficacy or viability of the agent classes or any of the individual agents. I have included agents classified by the military as obsolete along with those that are still considered a potential threat on the battlefield. It is important to remember that while an agent may have been a failure on the battlefield, it could still be a very successful weapon in the hands of a terrorist. In order to assure accuracy, all data has been cross checked over the widest variety of military, scientific and medical sources available.

Information in this handbook is a compilation gathered from numerous sources and arranged into the current format. In general, the most conservative recommendations have been incorporated

into each index. As with all hazardous materials and safety information, readers are encouraged to evaluate as many sources as they can find in order to make the most informed decisions. Any use of the information contained in this book must be determined by the user to be in accordance with their standard operating procedures as well as applicable national, regional and local laws and regulations.

Acknowledgements

I would especially like to thank Sarah for her input, comments and editing. She was able to clarify what I mistakenly thought was obvious.

There are numerous other individuals who have provided comments, insights and suggestions, on both of the previous editions as well as on the manuscript for this one. I appreciate them all. I have tried to address each of them, and incorporated changes that I believe have improved this edition. Any failures or omissions are mine and not due to a lack of vigilance or effort on the part of others.



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The importance of information is directly proportional to its improbability.
- *Fundamental Theorem of Information Theory*

Any fool can know. The point is to understand.
- *Albert Einstein*

In your thirst for knowledge, be sure not to drown in all the information.
- *Anthony J. D'Angelo*



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Explanatory Notes to Volume 1

Chemical agents are solids, liquids, or gases, which, through their chemical properties, produce lethal or damaging effects in man, animals, plants or materials. Historically, the military has divided chemical agents into categories based on the major physiological impact caused by the agent or the target organ they attack. While useful on the battlefield, this classification system may be misleading and confusing to civilian responders.

Biological agents can be grouped into two broad categories. The first involves living pathogens that cause disease in man, animals, or plants. This group is usually subdivided based on the type of pathogen involved (e.g., bacteria, viruses, fungi), and has some unique characteristics. These are the only agents that can multiply in the environment with the amount of agent increasing over time. They are also the only group in which secondary person-to-person transmission may be possible.

The second category of biological agents involves chemicals produced by living organisms that can kill or incapacitate other living creatures. The two classes discussed in this handbook are toxins and bioregulators (i.e., essential agents in the body that regulate and modulate a diverse set of key physiological and psychological processes). These agents are often classified as mid-spectrum agents – that is falling between the Chemical and Biological Weapon Conventions – because they can be harvested from living organisms or produced synthetically in a laboratory.

In this handbook, information about the agents is divided into classes based primarily on the common military groupings of chemical and biological agents. In instances where the divisions are too broad to allow appropriate identification of the chemical or physiological properties of the individual agents, additional classes are provided. There are also classes for nontraditional agents that do not fit neatly into one of the common military groupings and for industrial materials that could be used as improvised agents. Classes are identified by a number that corresponds to the first 21 chapters in this handbook (i.e., C01–C21). Classes contain general information about that specific group of agents. While this book covers most of the major classes of chemical and biological agents, it does not deal with anti-plant chemicals, anti-material agents, incendiary agents or obscurants.

At the end of each class is detailed technical information about individual agents, components or decomposition products within that class. Each of these individual materials is assigned a handbook number to allow for rapid identification and cross referencing throughout the book. The first three characters identify the agent class (e.g., **C01**). The letter following the hyphen (e.g., C01-**A**) indicates that the materials is primarily considered an agent (A), component or precursor of that class of agents (C), or is a significant decomposition product or impurity of that class of agents (D). The three digits that follow the letter indicate the specific agent in the order that it appears in the class (e.g., C01-A**001**). In some cases, handbook numbers only contain the first three characters (e.g., C01-A, C01-C, or C01-D) indicating that the material is an agent, component, or decomposition product in that class of chemical agents but there is insufficient data published on the physical, chemical or toxicological properties of the material to generate an individual entry.

There are four appendices that provide information on methods used to deliver chemical and biological agents, markings used to identify chemical munitions employed by various nations, biological risk/biosafety levels, and international and U.S. domestic lists of agents. These appendices are found at the end of volume 2.

There are six indices in this volume to allow easy access to specific agents in this handbook. These indices are the Alphabetical Index of names, the Chemical Abstract Service (CAS) numbers index, United Nations (UN) numbers index, European inventory of existing commercial chemical substances (EC) numbers index, U.S. Food and Drug Administration unique ingredient identifiers (UNII) index, and the International Classification of Diseases (ICD-11) index. There are four additional indices in volume 2 that cross-reference biological agents and include the European and

Mediterranean Plant Protection Organization (EPPO) codes index, an index of viruses by their taxonomic families, a cross index of vector and the diseases that they can carry, and a cross index of agriculturally significant flora and fauna with the diseases that can impact them. All of the indices contain synonyms and identifying numbers for the agents in this handbook that are cross-referenced to the individual agents via the handbook number.

Information in classes for chemical agents is in the following general format:

General Information
Toxicology (effects, pathways and routes of exposure, general exposure hazards, latency period)
Characteristics (physical appearance/odor, stability, persistency, environmental fate)
Additional Hazards (exposure, livestock/pets, fire, reactivity, hazardous decomposition products)
Protection (evacuation recommendations, personal protective requirements, decontamination)
Medical (Centers for Disease Control and Prevention (CDC) case definition, differential diagnosis, signs and symptoms, mass-casualty triage recommendations, casualty management, fatality management)

Information on the individual chemical agents is in the following general format:

Handbook Number
Name and reference numbers (CAS, RTECS, UN, ERG, EC, UNII, ICD-11)
Molecular structure and formula
Description of the agent
Additional information including mixtures with other agents, industrial uses, threat or treaty listing
Exposure hazards
AEGLs status and exposure values
Properties

Decontamination information contained in the class indices is directed at minimizing the threat during an emergency and may not be sufficient to allow unrestricted access by the general public. Thorough sampling should be conducted to determine additional remediation requirements.

Levels of protection identified in this volume follow the convention of the U.S. Environmental Protection Agency, which has established four basic levels for responding to hazardous material emergencies. Each level has benefits and limitations for the responder.

Level A provides the highest level of skin, eye and respiratory protection. It is selected when the hazardous material requires the highest level of protection; and there is a splash or vapor hazard that will be harmful to the skin or the material may be absorbed through the skin causing immediate serious injury or harm. Level A consist of a totally encapsulating suit and a supplied air respirator (i.e., SCBA or airline).

Level B provides the highest level of respiratory protection but has some exposed skin. It is selected when the hazardous material requires the highest level of protection, a totally encapsulating suit is not necessary, and some areas of unprotected skin will not adversely affect the responder. Level B consist of a supplied air respirator (i.e., SCBA or airline) and a chemical protective suit.

Level C provides some degree of skin and respiratory protection. It is selected when the hazardous material does not require the highest level of protection, a totally encapsulating suit is not necessary, and some areas of unprotected skin will not adversely affect the responder. In addition, the ambient oxygen level must be above 19.5% and, the identity as well as the concentration of the hazardous material must be known and measurable in real time. Level C consists of an air purifying respirator (i.e., on demand or powered) and a chemical protective suit.

Level D provides the least protection from potential chemical exposure. It is selected when there is no need for respiratory protection and minimal skin protection is needed. Level D may consist of coveralls or a chemical protective suit with some form of eye (e.g., glasses, goggles, face shields), hand (e.g., chemical resistant, abrasion or thermal protection) and foot protection.

Protective clothing can be made from any number of chemical resistant fabrics and must be selected based the chemicals involved in the emergency and the potential for exposure. Selection criteria include the possibility that chemical can degrade the protective fabric (i.e., physical destruction or reduction in one or more of the physical properties of the chemical protective clothing) or permeate through the fabric (i.e., process by which the hazardous material moves through the chemical protective clothing on a molecular level). Proper design and construction of the suit (e.g., splash guards, zipper covers, taped seams) is also essential to prevent penetration of the chemical through zippers, stitched seams or imperfection in the ensemble.

Abbreviations used in identifying individual agents are listed below. For any given parameter, a dash (i.e., —) means that the value is unavailable because it has not been determined or has not been published. An "NA" designation means that the parameter is not applicable or does not apply to that specific material. If the value of a parameter is an estimate, it is indicated by (est.).

CAS: Chemical Abstracts Service registry number. It is unique for each chemical without inherent meaning that is assigned by the Chemical Abstracts Service, a division of the American Chemical Society. It allows for efficient searching of computerized databases.

EC: a unique seven-digit identifier that was assigned to substances for regulatory purposes within the European Union by the European Commission. These materials were in the European Inventory of Existing Commercial chemical Substances, an inventory of chemicals that were deemed to be on the European Community market between 1 January 1971 and 18 September 1981.

ICD-11: 11th Revision of the International Statistical Classification of Diseases and Related Health Problems. It is the international standard diagnostic classification for all general epidemiological and many health management purposes.

RTECS: Registry of Toxic Effects of Chemical Substances number is a unique and unchanging identifier used to cross reference the RTECS database, which is a compendium of data extracted from the open scientific literature.

UN: United Nations identification number used in transportation of hazardous materials. If the substance is only listed under a generic class or group of materials (e.g., UN 2810: Toxic Liquids. Organic, N.O.S.), then it is not reported. The *ERG*: 2020 Emergency Response Guidebook number is reported following the UN number. As in the Guidebook, the letter "P" following the guide number indicates that the material has a significant risk of violent polymerization if not properly stabilized.

UNII: U.S. Food and Drug Administration Unique Ingredient Identifier numbers are unique, permanent identifiers for substances in regulated products for any material, and can from an atom to an organism.

Unless otherwise indicated, civilian exposure hazards are for a standardized individual (i.e., a male weighting 70 kg/154 lbs.) with a respiratory tidal volume of 15 liters/minute (i.e., resting). The military, because of the expected greater physical activity level of deployed soldiers, uses a standard 20 liters/minute respiratory tidal volume for their exposure guidelines (see MEG below). Other potential respiratory rates include walking (25 liters/minute), hard labor such as digging (60 liters/minute) or jogging (75 liters/minute). If a different breathing rate is used, then it is indicated in brackets. If temperature is a factor, then the critical values are indicated. The military typically classifies moderate temperatures as 65°F to 85°F. Temperature above 85°F are classified as hot.

Exposure parameters described below that have not been determined or have not been published for a specific material are not listed in those individual entries in this handbook. Older values of individual parameters from historic manuals that have not been updated in more current literature, are identified. In some cases, published toxicological endpoints allow relative comparisons to

know chemical agents (i.e., the nerve agents tabun, sarin, or VX). These are identified in individual entries when no other significant information on exposure hazards is available.

AEGL: Acute Exposure Guideline Levels describe the human health effects from once-in-a-lifetime, or rare, exposure to airborne chemicals and are intended for use by emergency responders when dealing with chemical spills or other catastrophic exposure events involving the general populace. In this handbook, only values for 1, 4 and 8 hours are denoted. Values that have not been developed or not recommended are annotated as "Not Developed." AEGLs appear in three categories:

AEGL-1 is the airborne concentration above which the general population could experience notable discomfort, irritation, or certain asymptomatic non-sensory effects. Effects are not disabling; they are transient and reversible.

AEGL-2 is the airborne concentration above which the general population could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape.

AEGL-3 is the airborne concentration above which the general population could experience life-threatening health effects or death.

The status indicates where the chemical is in the review process and includes Draft, Proposed, Interim, and Final. For more information, see the U.S. Environmental Protection Agency website at http://www.epa.gov/oppt/aegl/index.htm.

Ceiling: Exposure limit that specifies the concentration of vapor, dust or aerosol that should not be exceeded at any time during the workday. In some instances, a time limit for exposure to the ceiling value is established and is indicated in brackets. A [Skin] notation indicates that percutaneous absorption of the material is a potential hazard and may contribute to the overall exposure. The organization establishing the exposure limit is designated in subscript: NIOSH: National Institute for Occupational Safety and Health; ACGIH: American Conference of Governmental Industrial Hygienists; OARS: Occupational Alliance for Risk Safety. It is important to realize that these standards are intended to be applied to individuals who are adults (i.e., 16 years to 64 years old) and healthy enough to be employed full time. These standards are not appropriate for residential scenarios or for susceptible populations (e.g., children, the elderly, the infirmed, etc.).

Conversion Factor: Ratio of parts per million to milligrams per cubic meter at 77°F. Parts per million can be also be converted to milligrams per cubic meter at other temperatures by the following formula:

$$mg/m^3 = (ppm)(gmw)/RT$$

where:

mg/m^3 = the concentration in milligrams per cubic meter
ppm = the concentration in parts per million
gmw = the gram molecular weight of the agent
RT = theoretical molar volume of agent vapor in liters. The value of RT is determined by multiplying the temperature in degrees Kelvin by 0.08205. For 77°F, this value is 24.45.

GPL AEL: General Population Airborne Exposure Limits developed for the military by the Centers for Disease Control and Prevention (CDC) to protect neighboring populations during work to dismantle U.S. Army non-stockpile chemical materiel facilities. Values represent the concentration of chemical warfare agent (i.e., GA, GB, GD, GF, VX, HD, HT and L) that the unprotected general population can be exposed to 24 hours a day, 7 days a week, for a long period of time without experiencing any adverse health effects.

ICt_{50}: Is an expression of the dose of vapor or aerosolized agent necessary to incapacitate half of an exposed population. These values are expressed as milligram-minutes per cubic meter ($mg\text{-}min/m^3$).

The incapacitating concentration (IC_{50}) is determined by dividing the ICt_{50} by the duration of exposure in minutes. Values are for inhalation (Inh) and percutaneous (Per) exposures; and in the case of vesicants, damage to the skin (Skin) and eyes (Eyes). These dose-response values are not universally valid over all exposure periods and can lead to dangerous misinterpretations if used incorrectly. For inhalation of agent, time parameters are generally 2 to 8 minutes. For percutaneous absorption of agent, as well as for exposures that cause damage to the skin and eyes, time parameters are generally 2 minutes to 6 hours. Typically, an incapacitating concentration in parts per million (ppm) for a set exposure time is included in brackets following the mg-min/m^3 value.

ID_{50}: Amount of liquid or solid material required to incapacitate half of an exposed population. Values are for ingestion (Ing), percutaneous (Per) exposures and subcutaneous injection (Sub). These values are expressed as total milligrams per individual.

IDLH: Immediately Dangerous to Life or Health levels indicate that exposure to the listed concentrations of airborne contaminants is likely to cause death, immediate or delayed permanent adverse health effects, or prevent escape from the contaminated environment in a short period of time, typically 30 minutes or less. They indicate a maximum exposure level above which only individuals wearing a highly reliable breathing apparatus, providing maximum worker protection (e.g., SCBA), are permitted to enter.

Irritation values for eyes, skin and respiratory system. These values are expressed as a concentration (ppm for gases, mg/m^3 for aerosols) for a 2-minute exposure. Concentrations identified in the literature as "intolerable" to exposed individuals are also noted.

LCt_{50}: Is an expression of the dose of vapor or aerosolized agent necessary to kill half of an exposed population. These values are expressed as milligram-minutes per cubic meter (mg-min/m^3). The lethal concentration (LC_{50}) is determined by dividing the LCt_{50} by the duration of exposure in minutes. For example, the lethal concentration necessary to kill approximately 50 percent (LC_{50}) of people exposed for 2-minute to sarin vapor is approximately 18 mg/m^3 (6 ppm), while the LC_{50} for an 8-minute exposure is only 4.4 mg/m^3 (1.5 ppm). Values are for inhalation (Inh) and percutaneous (Per) exposures. These dose-response values are not universally valid over all exposure periods and can lead to dangerous misinterpretations if used incorrectly. For inhalation of agent, time parameters are generally valid within a range of 2 to 8 minutes. For percutaneous absorption of agent, time parameters are generally valid within a range of 30 minutes to 6 hours. Typically, a lethal concentration in parts per million (ppm) for a set exposure time is identified in brackets following the mg-min/m^3 value.

LC_{50}: Concentration of vapor or aerosolized agent necessary to kill half of an exposed population. Used when a specific set of exposure conditions (i.e., concentration and duration of exposure) are known but a more generalized dose-response (LCt_{50}) is not available.

LD_{50}: Amount of liquid or solid material required to kill half of an exposed population. Values are for ingestion (Ing), percutaneous (Per) exposures, and subcutaneous injection (Sub). These values are expressed as total milligrams per individual.

MEG: Military exposure guidelines for deployed military personnel. Levels reported in this handbook are for 1-hour exposures and generally consider three possible health endpoints related to a military operation.

Negligible (Neg): Continuous exposure to vapor concentrations above these levels could begin to produce mild, non-disabling, transient, reversible effects (e.g., mild irritation).

Marginal (Mar): Continuous exposure to vapor concentrations above these levels could produce some performance degradation, especially for tasks requiring extreme mental/visual acuity or physical dexterity/strength, in a portion of exposed individuals.

Critical (Crit): Continuous exposure to vapor concentrations above these levels could produce some potential life-threatening or lethal effects; particularly in personnel with underlying susceptibility factors.

A fourth health endpoint Catastrophic (Cat) is listed only for standard military chemical warfare agents. Continuous exposure to vapor concentrations these levels is anticipated to result in deaths and/or severe incapacitating effects that will likely require medical treatment.

Miosis: Concentration in parts per million (ppm) required to induce significant constriction of the pupil of the eye following a 2-minute exposure to the agent.

PACs: U.S. Department of Energy Protective Action Criteria designed to provide essential components for planning and response to uncontrolled releases of hazardous chemicals. PACs appear in three categories:

PAC-1 is the airborne concentration above which the general population could experience mild, transient health effects.

PAC-2 is the airborne concentration above which the general population could experience irreversible or other serious health effects that could impair the ability to take protective action.

PAC-3 is the airborne concentration above which the general population could experience life-threatening health effects.

PEL: Permissible Exposure Limits adopted by the Occupational Safety and Health Administration (OSHA) and based on a time-weighted average exposure over an 8-hour period and 40-hour work week. A [Skin] notation indicates that percutaneous absorption of the material is a potential hazard and may contribute to the overall exposure. It is important to realize that these standards are intended to be applied to individuals who are adults (i.e., 16 years to 64 years old) and healthy enough to be employed full-time. These standards are not appropriate for residential scenarios or for susceptible populations (e.g., children, the elderly, the infirmed, etc.).

REL: Recommended Exposure Limits recommended by the National Institute for Occupational Safety and Health (NIOSH) and based on a time-weighted average exposure over a 10-hour period and 40-hour workweek. A [Skin] notation indicates that percutaneous absorption of the material is a potential hazard and may contribute to the overall exposure. It is important to realize that these standards are intended to be applied to individuals who are adults (i.e., 16 years to 64 years old) and healthy enough to be employed full-time. These standards are not appropriate for residential scenarios or for susceptible populations (e.g., children, the elderly, the infirmed, etc.).

STEL: Short-Term Exposure Limits based on a time-weighted average exposure of 15minutes (unless otherwise noted). A [Skin] notation indicates that percutaneous absorption of the material is a potential hazard and may contribute to the overall exposure. The organization establishing the exposure limit is designated in subscript: NIOSH: National Institute for Occupational Safety and Health; ACGIH: American Conference of Governmental Industrial Hygienists; OARS: Occupational Alliance for Risk Safety. It is important to realize that these standards are intended to be applied to individuals who are adults (i.e., 16 years to 64 years old) and healthy enough to be employed full-time. These standards are not appropriate for residential scenarios or for susceptible populations (e.g., children, the elderly, the infirmed, etc.).

TLV: Threshold Limit Values recommended by the American Conference of Governmental Industrial Hygienists (ACGIH) and based on a time-weighted average exposure over an 8-hour period and 40-hour work week. A [Skin] notation indicates that percutaneous absorption of the material is a potential hazard and may contribute to the overall exposure. It is important to realize that these standards are intended to be applied to individuals who are adults (i.e., 16 years to 64 years old) and healthy enough to be employed full-time. These standards are not appropriate for residential scenarios or for susceptible populations (e.g., children, the elderly, the infirmed, etc.).

Vomiting: Inhaled concentration of vapor or aerosolized agent necessary to induce significant nausea and vomiting in half of an exposed population. These values are expressed as a concentration (ppm for gases, mg/m^3 for aerosols) for a 2-minute exposure.

WEEL: Workplace Environmental Exposure Levels were originally developed by the American Industrial Hygiene Association (AIHA). Since 2013, management of these exposure levels has been managed by the nonprofit organization **Toxicology Excellence for Risk Assessment and** published by the Occupational Alliance for Risk Science (OARS). These exposure limits are based

on a time-weighted airborne exposure averaged over an 8-hour workday and 40-hour workweek, and designed to protect most workers from adverse health effects related to occupational chemical exposures. It is important to realize that these standards are intended to be applied to individuals who are adults (i.e., 16 years to 64 years old) and healthy enough to be employed full time. These standards are not appropriate for residential scenarios or for susceptible populations (e.g., children, the elderly, the infirmed, etc.).

WPL AEL: Worker Population Airborne Exposure Limits developed for the military by the Centers for Disease Control and Prevention (CDC) to protect the chemical demilitarization workforce dismantling U.S. Army non-stockpile chemical materiel facilities. They are based on a time-weighted average exposure over an 8-hour period and a 40-hour workweek to select chemical warfare agents (i.e., GA, GB, GD, GF, VX, HD, HT and L).

In addition to the lists of reportable or controlled materials established by various treaties, governments and international organizations (i.e., the Chemical Weapons Convention schedules of chemicals, Australia's chemicals of security concern, the United States' select agents and toxins list, the U.S. Department of Homeland Security chemicals of concern list, the World Health Organization for Animals listed diseases, and the Australia Group common control lists), a number of agencies have established lists of commercially available materials that could be used by terrorists or insurgents as improvised chemical agents. These lists are identified where applicable in individual entries of the agent index. These lists are: The U.S. Federal Bureau of Investigation (FBI) list of highly toxic chemicals and pesticides judged likely to be used by terrorists, the International Taskforce-25 (ITF-25) list of agricultural and commercial industrial chemicals that could be significant in a military operation, and the U.S. Naval Research Laboratory (NRL) list of industrial chemicals for evaluation of chemical/biological defense systems. For more information on these and other sources of the agents detailed in this handbook see Appendix C in volume 2.

Unless otherwise indicated, chemical and physical properties are for the pure or production quality material. The literature values reported for these properties often reflect optimal or laboratory conditions and may differ from the behavior of the agent in the environment. Also, persistence and degradation of agents released inside buildings or confined spaces will vary from agents released in the open environment where they will be exposed to sunlight and the weather. Properties of mixed, binary, thickened, or dusty agents, even those in solutions, will have physical and chemical properties that vary from the listed values. These variations will depend on the proportion of agent to other materials (e.g., solvents, thickener, etc.) and the properties of these other materials. If available, data on mixtures or modified agents (e.g., salts) is included. For any given parameters, a dash (i.e., —) means that the value is unavailable because it has not been determined or has not been published.

BP: Boiling point of the material in degrees Fahrenheit at standard pressure (760 mm Hg). If a reduced pressure is reported, it is indicated in brackets following the boiling point. A designation of "decomposes" indicates that the agent will thermally decompose before it reaches its boiling point. A designation of "sublimes" indicates that the material goes directly from a solid to a gas without melting.

D: Density of the solid or liquid material at 68°F. If the density is reported for another temperature, it is indicated in brackets following the density. Liquefied gases are also indicated.

ER: Expansion ratio of a volatile liquid or liquified gas. Indicates the ratio of the volume of a given mass of liquified material compared to the theoretical volume of the same mass of material in the gaseous state at the same temperature and pressure.

FlP: Flashpoint of the material.

H_2O: Solubility of the agent in water. Solubilities are generally given in percentages indicating the weight of agent that will dissolve in the complementary amount of water. When quantitative solubility data is not available, qualitative terms (e.g., negligible, slight) are used to provide an intuitive evaluation of agent solubility. A designation of "miscible" indicates that the agent is soluble in water in all proportions. A designation of "insoluble" indicates that no appreciable

amount of the agent will dissolve in water. A designation of "reacts" indicates that the agent reacts with water and will decompose into other materials which may or may not be hazardous. If known, the rate of decomposition is indicated.

IP: Ionization potential is the amount of energy needed to remove an electron from a molecule of chemical vapor. The resultant ion is a charged particle that is detectable by various instrumentation such as photo ionization or flame ionization detectors.

LEL: Lower explosive limit in air, expressed as a percentage by volume.

MP: Melting point of the material in degrees Fahrenheit. A designation of "decomposes" indicates that the agent will thermally decompose before it reaches its melting point.

MW: Molecular or formula weight of the material.

RP: Relative persistency is a mathematical comparison of the evaporation and diffusion rates of water at 68°F to the evaporation and diffusion rates of the agent. The value represents an estimate of the ratio of the time required for a liquid or solid agent to dissipate as compared to the amount of time required for an equal mass of liquid water to dissipate. A value of "1" indicates that a puddle of the agent and a similar puddle of water will evaporate at about the same rate. The greater the value, the greater the proportional amount of time required for the agent to evaporate. For example, a value of "2" would mean that it would theoretically take approximately twice as long for the agent to evaporate as compared to a similar volume of water. Relative persistency is calculated by the formula:

$$RP = 4.34/p\ (K/M)^{1/2}$$

where:

RP = the relative persistency of the agent
p = the vapor pressure of the agent in mmHg at the temperature K
K = the ambient temperature in degrees Kelvin
M = the gram molecular weight of the agent

The relative persistency value does not account for additional factors that could impact the stability and persistence of a given agent, such as wind currents or decomposition due to reaction with other chemicals in the environment (e.g., water).

Sol: List of common organic solvents in which the material has appreciable solubility.

UEL: Upper explosive limit in air, expressed as a percentage by volume.

VD: Relative vapor density of the gaseous agent as compared to air. Unless otherwise indicated, these values are calculated based on the standard reference weight of air (i.e., 29).

Vlt: Volatility is the mass of agent in a unit of air that is saturated with the agent vapor. The volatility of an agent varies with temperature and it is often used to estimate the tendency of a chemical to vaporize or give off fumes. It can be calculated using the following formula:

$$Vlt = 16{,}040\ (gmw)p/T$$

where:

Vlt = the volatility of the agent in mg/m^3
gmw = the gram molecular weight of the agent
p = the vapor pressure of the agent in mmHg at the ambient temperature
T = the ambient temperature in degrees Kelvin

The volatility of a material can also be estimated in ppm by multiplying its vapor pressure in millimeters of mercury (mm Hg) by 1310.

Volatility is also sometimes used to estimate the persistency of an agent. However, it does not account for the migration (diffusion) of that vapor out of the area to allow more agent to evaporate. A better estimate of persistency is relative persistency (RP).

VP: Vapor pressure of the material in millimeters of mercury (mmHg) at 68°F. If another temperature is used, it is indicated in parentheses following the vapor pressure.

Vsc: Dynamic viscosity of the material in centistokes (cS). Obtained when the absolute viscosity, expressed as centipoise, is divided by the specific gravity of the material.



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Author

D. Hank Ellison served in the U.S. Army as a chemical officer and has worked for the U.S. Environmental Protection Agency as both a remedial project manager and federal on-scene coordinator under the Superfund Program. He currently is president of Cerberus & Associates, Inc., a consulting firm that specializes in response to technological disasters. As a private consultant, Ellison has responded to hazardous material incidents involving highly poisonous materials, chemical fires, water reactive substances and shock-sensitive materials throughout the state of Michigan. He has provided chemical and biological counterterrorism training to members of emergency medical service (EMS) units, hazardous materials (hazmat) teams, police special weapons and tactics (SWAT) teams and explosive ordinance disposal (EOD) teams. During the anthrax events of 2001, he helped state and local governments as well as *Fortune* 500 companies to develop and implement response plans for biological threats. He currently advises clients on issues of hazardous materials, and related safety and security concerns.

He also served as a safety officer and then the training officer for the U.S. Department of Health and Human Services DMORT-WMD emergency response team, which has the primary mission for recovery and decontamination of fatalities contaminated with radiological, biological or chemical materials. He deployed with the team to New Orleans in response to Hurricane Katrina in 2005. He has a master of science degree in chemistry from the University of California, Irvine. His graduate research involved methods to synthesize poisons extracted from Colombian poison-dart frogs. He has a bachelor of science in chemistry from the Georgia Institute of Technology. In addition to his works on weapons of mass destruction, he is the author of *Chemical Warfare During the Vietnam War: Riot Control Agents in Combat*, published in 2011, as well as a chapter on the hazardous properties of materials in *Managing Hazardous Materials: A Definitive Text* published in 2002.



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Nerve Agents



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1 Organophosphorus Nerve Agents

GENERAL INFORMATION

There are five major series of organophosphorus nerve agents.

G-Series Nerve Agents

These agents are alkyl phosphonofluoridates, alkyl phosphoramidocyanidates, and alkyl phosphonofluoridothiates. The original agents in this series – tabun (C01-A001), sarin (C01-A002), and soman (C01-A003) – were developed by German scientists during the 1930s. Both tabun and sarin were stockpiled by Nazi Germany during World War II but were never used. Since the end of World War II, modern weapons researchers have evaluated numerous other variations of the basic phosphonofluoridate and phosphoramidocyanidate structures. Although G-series agents have been stockpiled by most countries that have pursued a chemical weapons program, they have been used only a limited number of times on the battlefield. They have also been used by terrorists as a mass casualty agent.

The majority of G-series agents are listed in Schedule 1 of the Chemical Weapons Convention as long as they are within the following limitations:

> O-Alkyl (less than or equal to C10, including cycloalkyl) alkyl (methyl, ethyl, propyl, or isopropyl) phosphonofluoridates,
>
> OR
>
> O-Alkyl (less than or equal to C10, including cycloalkyl) N,N-dialkyl (methyl, ethyl, propyl, or isopropyl) phosphoramidocyanidates.

V-Series Nerve Agents

These agents are alkyl S-2-dialkylaminoethyl alkyl phosphonothiolates, dialkyl S-2-dialkylaminoethyl phosphorothiolates, and alkyl S-2-dialkylaminoethyl alkyl phosphonoselenoates. The first of these agents – Amiton (C01-A013) – was developed and patented in Britain in the early 1950s by Imperial Chemicals Industries Limited as a pesticide. Since that time, modern weapons researchers have evaluated numerous other variations of the basic phosphorothiolate structure. Researchers have also developed quaternary amine salts of agents to enhance their ability to penetrate into neuromuscular junctions. Although stockpiled by a number of countries, V-series agents have never been used on the battlefield. They have been used in a limited way for political assassinations (e.g., of Kim Jong-nam in 2017) and terrorist murders (e.g., by the Aum Shinrikyo in the 1990s).

The majority of V-series agents are listed in Schedule 1 of the Chemical Weapons Convention as long as they are within the following limitations:

> O-Alkyl (H or less than or equal to C10, including cycloalkyl) S-2-dialkyl (Me, Et, n-Pr or i-Pr)-aminoethyl alkyl (Me, Et, n-Pr or i-Pr) phosphonothiolate and corresponding alkylated or protonated salts.

Amiton (C01-A013) is listed under Schedule 2 of the Chemical Weapons Convention.

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GV-Series Nerve Agents

These agents are alkyl phosphoramidofluoridates. They were developed by the United States in the 1970s. GV-series agents were designed to possess the key advantages of the higher volatility of G-series agents and the high percutaneous toxicity of V-series agents. Researchers have also developed quaternary amine salts of agents to enhance their ability to penetrate into neuromuscular junctions. Based on available information, GV-series agents have only been used for research purposes.

GV-series agents are not specifically listed in the Chemical Weapons Convention, nor are they covered by the language of the general definitions. However, because of their toxicity and lack of commercial application, they would be prohibited based on the Guidelines for Schedules of Chemicals.

Novichok- (or A-) Series Nerve Agents

These agents are P-alkyl-N-fluorophosphonyl amidines, O-alkyl-N-fluorophosphoryl amidines or P-alkyl-N-fluorophosphonyl guanidines. They are also referred to as fourth-generation nerve agents and were developed by the Former Soviet Union. Research on novichok agents began in the 1960s and continued through the early 1990s under the Foliant program. Minimal information about these agents or this research program has been published in the unclassified literature. Although production of several thousand tons for testing purposes has been reported, there is no information to indicate that these agents were ever stockpiled in the Soviet arsenal. They have never been used on the battlefield. They have been used for political assassination attempts (e.g., Sergei Skripal in 2018 and Alexei Navalny in 2020).

The majority of novichok-series agents are listed in Schedule 1 of the Chemical Weapons Convention as long as they are within the following limitations:

> P-Alkyl (H or < C10, including cycloalkyl) *N*-(1-(dialkyl (< C10, including cycloalkyl) amino)) alkylidene (H or < C10, incl. cycloalkyl) phosphoramidic fluorides and corresponding alkylated or protonated salts,
>
> OR
>
> O-Alkyl (H or < C10, including cycloalkyl) *N*-(1-(dialkyl (< C10, including cycloalkyl) amino)) alkylidene (H or < C10, incl. cycloalkyl) phosphoramidofluoridates and corresponding alkylated or protonated salts.

Oxime-Series Agents

Are another series of chemical warfare agent that were developed by the Former Soviet Union along with the novichok agents. These agents are fluorophosphoryl dihaloformaldoximes or fluorophosphoryl (difluoronitromethyl)fluroformaldoximes. Minimal information about these agents or this research program has been published in the unclassified literature. There is no information to indicate that these agents were ever accepted by the military as warfare agents, and based on the development of the more toxic novichok series, it is likely that they were abandoned as a research sideline. After the political assassination attempts employing novichok agents, the Russian government unsuccessfully proposed to add theses agent to Schedule 1 of the Chemical Weapons Convention. While the Oxime-series agents are not specifically listed in the Chemical Weapons Convention, because of their toxicity and lack of commercial application, they would be prohibited based on the Guidelines for Schedules of Chemicals.

Organophosphorus nerve agents are relatively easy to synthesize and disperse. Oxime-series agents are moderately difficult to synthesize. For information on some of the chemicals used to manufacture nerve agents, see the component section (C01-C) following information on the individual agents in this chapter. Overall, nerve agents are easy to deliver. Although no specific

information is available on dispersing novichok or oxime-series agents, other than for assassinations, they should perform similarly to other organophosphorus nerve agents.

In addition to the agents detailed in this handbook, the OPCW identifies numerous other G-series and V-series organophosphorus nerve agents in its "Handbook on Chemicals 2019," Appendix 2 in the *Declarations Handbook for the Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction*. However, no information is available in the unclassified literature concerning the physical, chemical, or toxicological properties of these additional agents.

TOXICOLOGY

Effects

Nerve agents are the most toxic of formerly stockpiled man-made chemical warfare agents. These compounds are similar to, but much more deadly than, agricultural organophosphate pesticides. Nerve agents disrupt the function of the nervous system by interfering with the enzyme acetylcholinesterase. Serious effects are on skeletal muscles and the central nervous system. Nerve agents also affect glands that discharges secretions to the outside of the body causing discharge of mucous, saliva, sweat, and gastrointestinal fluids. Exposure to solids, liquids, or vapors from these agents is hazardous and can result in death within minutes of exposure.

Pathways and Routes of Exposure

Nerve agents are hazardous through any route of exposure including inhalation, exposure of the skin and eye to either liquid or vapor, ingestion, and broken, abraded, or lacerated skin (e.g., penetration of skin by debris). Thickened agents primarily pose a hazard through skin absorption. Dusty agents are primarily an inhalation hazard although percutaneous absorption is possible especially if there is contact with bulk agent.

General Exposure Hazards

Organophosphorus nerve agents do not have good warning properties. They have little or no odor, and, other than causing miosis, the vapors do not irritate the eyes. Contact with liquid agent neither irritates the skin and nor causes cutaneous injuries. Exposure to GV-series agents produces fewer, milder, and more transient physiological symptoms than seen with either the G-series or V-series agents.

G-series

Lethal concentrations (LC_{50}s) for inhalation of G-series agents are as low as 2 parts per million for a 2-minute exposure.

Lethal percutaneous exposures (LD_{50}s) to liquid G-series agents are as low as 0.17 grams per individual.

Miosis from exposure of the eyes to G-series agent vapors occurs after exposures to as little as 0.01 parts per million for 2 minutes.

V-series

Lethal concentrations (LC_{50}s) for inhalation of V-series agents are as low as 0.69 parts per million for a 2-minute exposure.

Lethal percutaneous exposures (LD_{50}s) to liquid V-series agents are as low as 0.005 grams per individual.

Miosis from exposure of the eyes to V-series agent vapors occurs after exposures to as little as 0.005 parts per million for 2 minutes.

GV-series

Human toxicity data for these nerve agents has not been published or has not been established.

Novichok-series

Human toxicity data for the novichok series nerve agents has not been published or has not been established. However, available information indicates that under optimum conditions novichok agents are 5 to 10 times more toxic than nerve agent VX (C01-A017).

Oxime-series

Human toxicity data for the oxime series nerve agents has not been published or has not been established.

The rate of detoxification of organophosphorus nerve agents by the body is very low. Exposures are essentially cumulative.

Latency Period

Vapor/Aerosols (inhalational mists or dusts)

Depending on the concentration of agent vapor, the effects begin to appear 30 seconds to 2 minutes after initial exposure.

Liquids

Typically, there is a latent period with no visible effects between the time of exposure and the sudden onset of symptoms. This latency can range from 1minute to 18 hours for G-, V-, and GV-series agents. Novichok series agents, however, undergo a deposit effect in the dermal layer and exposed individuals can take up to 3 days to present symptoms. Some factors affecting the length of time before the onset of symptoms are the amount of agent involved, the amount of skin surface in contact with the agent, previous exposure to materials that chap or dry the skin (e.g., organic solvents such gasoline or alcohols), and addition of additives designed to enhance the rate of percutaneous penetration by the agents.

Another key factor affecting the rate of percutaneous penetration by the agent is the part of the body that is exposed. It takes the agent longer to penetrate thicker and tougher skin. The regions of the body that allow the fastest percutaneous penetration are the groin, head and neck. The least susceptible body regions are the hands, feet, front of the knee, and outside of the elbow.

Solids (non-aerosol)

Typically, there is a latent period with no visible effects between the time of exposure and the sudden onset of symptoms. This latency can range from 1minute to 3 days and is affected by such factors as the amount of agent involved, the amount of skin surface in contact with the agent and the area of the body exposed (see Liquids). Moist, sweaty areas of the body are more susceptible to percutaneous penetration by solid nerve agents.

CHARACTERISTICS

Physical Appearance/Odor

Laboratory Grade

Laboratory grade agents are typically colorless with a consistency ranging from water to motor oil. Salts are colorless to white crystalline solids. Neither solids nor liquids have any significant odor when pure.

Munition Grade

Munition grade agents are typically yellow to brown liquids or solids. As the agent ages and decomposes, it continues to discolor until it may appear black. Production impurities and decomposition products in these agents may give them an odor. Odors for G-series agents have been described as fruity, camphor-like, or similar to bitter almonds. Odors for V-series agents have been described as resembling rotten fish or smelling of sulfur. Odors for all agents may become more pronounced during storage.

Binary Agents

Binary versions of all series of organophosphorus nerve agents have been developed. A binary agent consists of two components, either solids or liquids, that form a standard nerve agent when they are mixed. Since the agent is formed just prior to or as a result of deployment, the product formed by mixing the components is crude and will consist of the agent, the individual components, and any by-products formed during the reaction. The color, odor, and consistency of the resulting agent will vary depending on the quality of the components and the degree of mixing.

The components, by-products of the reaction, or solvents used to facilitate mixing the components may have their own toxic properties and could present additional hazards. They may also change the rate that the binary nerve agent volatilizes or penetrates the skin. Residual components may react with common materials, such as alcohols, to produce other nerve agents. For data on binary components, see the component section (C01-C) following information on the individual agents.

Modified Agents

Solvents have been added to nerve agents to facilitate handling, stabilize the agents or to increase the ease of percutaneous penetration by the agents. Percutaneous enhancement solvents include dimethyl sulfoxide, N,N-dimethylformamide, N,N-dimethylpalmitamide, N,N-dimethyldecanamide, and saponin. Color and other properties of these solutions may vary from the pure agent. Odors will vary depending on the characteristics of the solvent(s) used and concentration of nerve agent in the solution.

Conversely, nerve agents have also been thickened with various substances to enhance deployment, increase their persistency, and increase the risk of percutaneous exposure and cross contamination. Thickeners include polyalkyl methacrylates (methyl, ethyl, butyl, isobutyl), polyvinyl acetate, polystyrene, plexiglass, alloprene, polychlorinated isoprene, nitrocellulose, as well as bleached montan and lignite waxes. Military thickener K125 is a mixture of methyl, ethyl and butyl polymethacrylates. When thickened, agents become sticky with a consistency similar to honey. Typically, not enough thickener is added to significantly affect either the color or odor of the agent.

Nerve agents have also been converted to a dusty form by adsorbing the liquid agent onto a solid carrier. Dusty carriers include aerogel, talc, alumina, silica gel, diatomite, kaolinite, fuller's earth, and pumice. Dusty agents appear as finely ground, free-flowing powders with individual particles in the range of 10 microns or less and are dispersed as a particulate cloud. Particles in this range can penetrate clothing and breathable protective gear. Dusty agents pose both an inhalation and contact hazard. Color and other physical properties of dusty agents will depend upon the characteristics of the carrier. Odors may vary from the unmodified agent.

Stability

Crude G-series agents are relatively stable at low to moderate temperatures. Stability increases with purity and distilled materials can be stored even under tropical conditions. The presence of moisture facilitates decomposition of agents during storage. Stabilizers may be added to remove moisture and to react with acidic decomposition products. Stabilizers are typically diisopropylcarbodiimide or dicyclohexylcarbodiimide, but can also be tributylamine or dibutylchloramine.

For additional information on these stabilizers, see the component section (C01-C) following information on the individual agents in this chapter. Agents can be stored in glass or steel containers. Aluminum is acceptable if the agent has been stabilized.

Crude V-series agents are relatively stable at low to moderate temperatures. Stability increases with purity, and distilled materials can be stored even under tropical conditions. Agents undergo gradual deterioration during storage that is autocatalytic and accelerated by moisture or impurities normal to agent production. Stabilizers may be added to remove moisture and to react with acidic decomposition products. Stabilizers are carbodiimides such as diisopropylcarbodiimide or dicyclohexylcarbodiimide. For additional information on these stabilizers, see the component section (C01-C) following information on the individual agents in this chapter. Agents can be stored in aluminum, glass, or steel containers. Agents can deteriorate in the presence of silver found in some solders or brazes, and in the presence of rust.

Liquid GV-series agents are not as stable as either G-series or V-series agents and tend to decompose during storage. Purified salts are stable over extended periods. Agents can be stored in glass containers.

Novichok series agents are soluble and not readily degraded by water. They are persistent in aqueous solutions. Other information on the stability of these agents has not been published in the unclassified literature. However, intelligence information indicates that novichok agents have been field tested and were adopted for potential inclusion into the former USSR military arsenal and, therefore, can be stored over extended periods. The need for, or identity of, stabilizers has not been reported.

Information on the stability of oxime-series agents has not been published in the unclassified literature.

Persistency

Depending on the properties of the specific agent, unmodified G-series agents are classified as either non-persistent or moderately persistent by the military. Evaporation rates range from near that of water down to that of light machine oil.

Unmodified V-series agents are classified as persistent by the military. Evaporation rates range from near that of light machine oil down to that of motor oil.

Depending on the properties of the specific agent, unmodified GV-series agents are classified as either moderately persistent or persistent by the military. Evaporation rates range from near that of light machine oil down to near that of motor oil.

Unmodified novichok agents are persistent for extremely long periods of time on materials and in water.

Information on the persistency of oxime-series agents has not been published in the unclassified literature.

The addition of solvents, thickeners, or conversion to a dusty form may alter the persistency of these agents. Thickened agents will persist significantly longer after dispersal than unmodified agents. Dusty agents can be very persistent depending on the carrier employed and can be re-aerosolized by ground traffic or strong winds.

Salts of agents have negligible vapor pressure and will not evaporate. Depending on the size of the individual particles and on any encapsulation or coatings applied to the particles, they can be re-aerosolized by ground traffic or strong winds.

Environmental Fate

Organophosphorus nerve agent vapors have a density greater than air and tend to collect in low places. Porous material, including painted surfaces, will absorb both liquid and gaseous agent. After the initial surface contamination has been removed, agent that has been absorbed into porous material can migrate back to the surface posing both a contact and vapor hazard. Clothing may emit trapped agent vapor for up to 30 minutes after contact with a vapor cloud.

Novichok agents are highly soluble in water. With the exception of sarin (C01-A002), which is miscible with water, most other organophosphate nerve agents are only slightly soluble or insoluble in water. V-series agents are unusual in that they tend to be more soluble in cold water than in hot water. However, the solubility of any agent may be modified (either increased or decreased) by solvents, components, or impurities. The specific gravities of unmodified liquid agents are slightly greater than that of water. Nerve agents are soluble in most organic solvents including gasoline, alcohols, and oils. V-series and GV-series agents are also soluble in mildly acidic aqueous solutions. Salts of organophosphorus nerve agents are water soluble.

ADDITIONAL HAZARDS

Exposure

Individuals who have had previous exposure to materials that chap or dry the skin, such as alcohols, gasoline or paint thinners, may be more susceptible to percutaneous penetration of liquid agents. In these situations, the rate of percutaneous penetration of the agent is greatly increased resulting in a decrease in the survival time that would otherwise be expected.

All foodstuffs in the area of a release should be considered contaminated. Unopened items packaged in glass, metal, or heavy-duty plastic and exposed only to agent vapors may be used after decontamination of the container. Unopened items exposed to liquid agents should be decontaminated within a few hours post-exposure or destroyed. Opened or unpackaged items, or those packaged only in paper or cardboard, should be destroyed.

Meat, milk, and animal products from livestock exposed to novichok agents that survives the incident and does not show any adverse effects thirty days post-exposure should be safe to consume. Otherwise, meat, milk, and animal products, including hides, from animals exposed to novichok agents should be destroyed. Meat from animals that have suffered only mild to moderate effects from exposure to other nerve agents should be safe to consume. Milk should be discarded for the first 7 days post-exposure and then should be safe to consume. Meat, milk, and animal products, including hides, from animals severely affected or killed by nerve agents should be destroyed.

Plants, fruits, vegetables, and grains should be quarantined until tested and determined to be safe to consume. In addition to a direct contact hazard, some G-series agents can translocate from roots to other areas (e.g., leaves, fruit, etc.) of some plants and may pose an ingestion hazard.

Livestock/Pets

Animals can be decontaminated with shampoo/soap and water, or a 0.5% household bleach solution (i.e., no more than one-part household bleach in nine-parts water). If the animal's eyes have been exposed to agent, they should be irrigated with water or saline solution for a minimum of 30 minutes.

The topmost layer of unprotected feedstock (e.g., hay or grain) should be destroyed. The remaining material should be quarantined until tested. Leaves of forage vegetation could still retain sufficient nerve agent to produce mild to moderate effects for several weeks post-release, depending on the level of contamination and the weather conditions. G-series nerve agents that have translocated to the leaves or fruit of plants may pose an extended ingestion hazard.

Fire

Heat from a fire will increase the amount of agent vapor in the area. A significant amount of the agent could be volatilized and escape into the surrounding environment before it is consumed by the fire. Actions taken to extinguish the fire can also spread the agent. Novichok agents and sarin

(C01-A002) are highly soluble in water. Runoff may be extremely toxic and could contaminate larger areas. Other nerve agents are only slightly soluble or insoluble in water. However, because of their extreme toxicity, runoff from firefighting efforts will still pose a significant threat. Some of the decomposition products resulting from hydrolysis or combustion of nerve agents are water soluble and highly toxic (see Hazardous Decomposition Products below). Other potential decomposition products include toxic and/or corrosive gases.

Reactivity

Most organophosphorus nerve agents decompose slowly in water. Raising the pH of an aqueous solution of these agents significantly increases the rate of decomposition. Reaction with dry bleach (e.g., HTH, STB) may produce toxic gases.

Hazardous Decomposition Products

For information on individual impurities and decomposition products, see the decomposition products and impurities section (C01-D) at the end of this chapter.

Hydrolysis

G-Series Nerve Agents

Agents produce hydrogen fluoride (HF) or hydrogen cyanide (HCN) when hydrolyzed. Some may produce hydrogen chloride (HCl).

V-Series Nerve Agents

Extremely toxic decomposition products, including S-[2-dialkylaminoethyl] alkyl phosphonothioic acids and alkyl pyrophosphonates, may be produced by hydrolysis.

GV-Series Nerve Agents

Agents produce hydrogen fluoride (HF) when hydrolyzed. Additional products, depending on the pH, include amines and complex organophosphates that should be considered to be extremely toxic.

Novichok Agents

Agents produce hydrogen fluoride (HF) when hydrolyzed.

Oxime-Series Nerve Agents

Agents produce hydrogen fluoride (HF), hydrogen chloride (HCl), or hydrogen cyanide (HCN) when hydrolyzed. They may also produce highly toxic oximes.

Combustion

G-Series Nerve Agents

Volatile decomposition products may include hydrogen fluoride (HF), hydrogen chloride (HCl), hydrogen cyanide (HCN), sulfur oxides (SO_x), and phosphorous oxides (PO_x) as well as potentially toxic organophosphates. In addition, toxic phosphate residue may remain.

V-Series Nerve Agents

Volatile decomposition products may include sulfur oxides (SO_x), nitrogen oxides (NO_x), and phosphorous oxides (PO_x) as well as potentially toxic organophosphates. In addition, toxic phosphate residue may remain.

GV-Series Nerve Agents

Volatile decomposition products may include hydrogen fluoride (HF), nitrogen oxides (NO_x), and phosphorous oxides (PO_x) as well as potentially toxic organophosphates. In addition, toxic phosphate residue may remain.

Novichok Agents

Volatile decomposition products may include hydrogen fluoride (HF), nitrogen oxides (NO_x), and phosphorous oxides (PO_x) as well as potentially toxic organophosphates. In addition, toxic phosphate residue may remain.

Oxime Series Agents

Volatile decomposition products may include hydrogen fluoride (HF), hydrogen chloride (HCl), hydrogen cyanide (HCN), and phosphorous oxides (PO_x) as well as potentially toxic organophosphates. In addition, toxic phosphate residue may remain.

PROTECTION

Evacuation Recommendations

Isolation and protective action distances listed below are taken from the 2020 Emergency Response Guidebook. For organophosphorus nerve agents, these recommendations are based on a release scenario involving either a spray or explosively generated mist of nerve agent that quickly settles to the ground and soaks in to a depth of no more than 0.25 millimeters. A secondary cloud will then be generated by evaporation of this deposited material. A small release involves 2 kilograms (approximately 1.8 liters) of liquid agent and a large release involves 25 kilograms (approximately 23 liters) of liquid agent.

GA (Tabun) *C01-A001*

	Initial Isolation	Downwind Day	Downwind Night
Small device (2 kg)	30 m	0.2 km	0.2 km
Large device (25 kg)	100 m	0.5 km	0.6 km

GB (Sarin) *C01-A002*

	Initial Isolation	Downwind Day	Downwind Night
Small device (2 kg)	60 m	0.4 km	1.1 km
Large device (25 kg)	400 m	2.1 km	4.9 km

GD (Soman) *C01-A003*

	Initial Isolation	Downwind Day	Downwind Night
Small device (2 kg)	60 m	0.4 km	0.7 km
Large device (25 kg)	300 m	1.8 km	2.7 km

GF (Cyclosarin) *C01-A005*

	Initial Isolation	Downwind Day	Downwind Night
Small device (2 kg)	30 m	0.2 km	0.3 km
Large device (25 kg)	150 m	0.8 km	1.0 km

VX*C01-A017*

	Initial Isolation	Downwind Day	Downwind Night
Small device (2 kg)	30 m	0.1 km	0.1 km
Large device (25 kg)	60 m	0.4 km	0.3 km

Personal Protective Requirements

Structural Firefighters' Gear

Structural firefighters' protective clothing is recommended for fire situations only; it is not effective in spill situations or release events. If chemical protective clothing is not available and it is necessary to rescue casualties from a contaminated area, then structural firefighters' gear will provide very limited skin protection against nerve agent vapors. Contact with liquids, solids, and solutions should be avoided.

In the event entry is made into an environment contaminated with nerve agent vapor, responders are at a significantly greater risk of exposure and resultant adverse effects. Using the 3/30 Rule, operations in structural firefighters' gear should only be undertaken if there are known living victims and vapor concentrations have peaked. Entries must be limited to 30 minutes. If there are no known living victims, then entries must be limited to 3minutes. Even operating within these constraints, up to 50% of the firefighters who enter a contaminated area wearing only structural firefighters' gear may experience mild to moderate effects. In addition, since exposures to nerve agents are essentially cumulative, all responders who enter the hot zone without appropriate chemical protective clothing are at increased risk during the remainder of the emergency.

Respiratory Protection

Self-contained breathing apparatuses (SCBAs) or air purifying respirators (APRs) should have a NIOSH CBRN certification since nerve agents can degrade the materials used to make some respirators. However, during emergency operations, other NIOSH-approved SCBAs or APRs that have been specifically tested by the manufacturer against chemical warfare agents may be used if deemed necessary by the incident commander. APRs should be equipped with a NIOSH-approved Chemical/Biological/Radiological/Nuclear (CBRN) filter or a combination organic vapor/acid gas/particulate cartridge.

Immediately dangerous to life or health (IDLH) levels are the ceiling limit for respirators other than SCBAs. Any exposures approaching the IDLH level should be regarded with extreme caution and the use of SCBAs for respiratory protection should be considered.

Chemical Protective Clothing

Use only chemical protective clothing that has undergone material and construction performance testing against the series of nerve agent that has been released. There is currently no information on performance testing of chemical protective clothing against GV-series, novichok, or oxime-series agents. However, current recommendations for responding to an emergency involving these agents specify the use of chemical resistant fabrics that provide protection against VX (C01-A017) in

conjunction with chemical resistant boots and butyl rubber gloves that have a minimum thickness of at least 14 millimeters. In all cases, reported permeation rates may be affected by solvents, components, or impurities in munition grade or binary agents.

In addition to the risk of percutaneous migration of agent following dermal exposure to liquid agents, nerve agent vapors can also penetrate the skin and produce a toxic effect. However, these concentrations are significantly greater than concentrations that will produce similar effects if inhaled. If the concentration of vapor exceeds the level necessary to produce effects through dermal exposure, then responders should wear a Level A protective ensemble.

Decontamination

General

G-Series Nerve Agents

These agents are readily destroyed by high pH (i.e., basic solutions). Use an aqueous caustic solution (minimum of ten percent by weight sodium hydroxide or sodium carbonate) or use undiluted household bleach. However, hydrolysis of G-series agents produces acidic by-products so a large excess of base will be need to ensure complete destruction of the agents. Due to the extreme volume required, household bleach is not an efficient means of decontaminating large quantities of these agents. Basic peroxides (e.g., a solution of baking soda, 30 to 50% hydrogen peroxide and an alcohol) also rapidly detoxify G-series agents.

Avoid using highly concentrated caustic solutions because agents can become insoluble. Any agent that does not dissolve in the aqueous caustic solution will not be hydrolyzed. An agent will also be insoluble if it is dissolved in an immiscible organic solvent or if it is thickened such that it forms a protective layer at the agent/water interface. The addition of solvents or mechanical mixing may be required to overcome insolubility problems. Also, it is important to ensure that the pH of the final waste solution remains basic. If the pH is below seven, fluoride ions can react with methylphosphonate diesters, a common impurity in these agents, to regenerate the nerve agent.

Solid hypochlorites (e.g., HTH, STB, and Dutch powder) are also effective in destroying G-series agents. Reaction with hypochlorites, including household bleach, may produce toxic gases such as chlorine.

Reactive skin decontaminant Lotion (RSDL) containing aqueous solutions of oxime salts, Sandia decontamination foam formulations containing high pH aqueous solutions of hydrogen peroxide, Canadian Aqueous System for Chemical-Biological Agent Decontamination (CASCAD) containing aqueous solutions of chloroisocyanurates and complexing agents, as well as Dahlgren decontamination formulations containing aqueous solutions of peracetyl borate and surfactants are all effective at detoxifying G-series agents.

V-Series Nerve Agents

It is difficult to detoxify V-series agents with aqueous caustic solutions alone due to their limited solubility at high pH. Solubility of an agent can be further reduced if it is dissolved in an immiscible organic solvent or if it has been thickened such that it forms a protective layer at the agent/water interface. In addition, V-series agents can react with aqueous caustic to produce stable and highly toxic S-[2-dialkylaminoethyl] alkyl phosphonothiolates as by-products. These alkyl phosphonothiolates have toxicities near those of the original agents. They are persistent and resist further hydrolysis. For additional information on these hazardous decomposition products, see the decomposition products and impurities section (C01-D) at the end of this chapter. To prevent the formation of these alkyl phosphonothiolates, the reaction must be heated in excess of 180°F. Anhydrous solutions of caustic in alcohol are effective for destroying V-series agents without the production of alkyl phosphonothiolates. Basic peroxides (e.g., a solution of baking soda, 30 to 50% hydrogen peroxide and an alcohol) also rapidly detoxify V-series agents.

Household bleach is not an efficient means of decontaminating large quantities of V-series agents. In addition to limited solubility in commercial bleach due to the high pH, a minimum tenfold excess of active chlorine to nerve agent is required to ensure destruction of the agent.

V-series agents react vigorously with caustics producing heat and off-gassing. Under these conditions, the amount of vapor given off by unreacted agent can increase significantly.

V-series agents can be destroyed by aqueous solutions of strong oxidizing agents, but cannot be rendered non-toxic by oxidation without the presence of water. If a weak oxidizer or if an insufficient amount of a strong oxidizer is used, then toxic by-products will remain.

An effective decontamination solution for V-series agents is prepared by mixing an aqueous HTH slurry (10% by weight HTH) with alcohol in a 9:1 ratio. This solution should be prepared just prior to use. The reaction will produce heat and a significant amount of gas. Use a large excess of neutralizing solution to ensure agent destruction and allow the it to remain in contact with the agent for a minimum of 1hour. Adjust the pH of the resulting waste solution to 12.5 or more using a ten percent aqueous sodium hydroxide solution.

Reactive skin decontaminant Lotion (RSDL) containing aqueous solutions of oxime salts, Sandia decontamination foam formulations containing high pH aqueous solutions of hydrogen peroxide, Canadian Aqueous System for Chemical-Biological Agent Decontamination (CASCAD) containing aqueous solutions of chloroisocyanurates and complexing agents, as well as Dahlgren decontamination formulations containing aqueous solutions of peracetyl borate and surfactants are all effective at detoxifying V-series agents.

GV-Series Nerve Agents

These agents are readily destroyed by high pH (i.e., basic solutions). Use an aqueous caustic solution (minimum of 10% by weight sodium hydroxide or sodium carbonate) containing 20% alcohol or use undiluted household bleach. However, hydrolysis of GV-series agents produces acidic by-products so a large excess of base will be need to ensure complete destruction of the agents. Due to the extreme volume required, household bleach is not an efficient means of decontaminating large quantities of these agents. Basic peroxides (e.g., a solution of baking soda, 30 to 50% hydrogen peroxide and an alcohol) also rapidly detoxify GV-series agents.

Avoid using highly concentrated caustic solutions because agents can become insoluble. Any agent that does not dissolve in the aqueous caustic solution will not be hydrolyzed. An agent will also be insoluble if it is dissolved in an immiscible organic solvent. Addition of solvents or mechanical mixing may be required to overcome insolubility problems.

Solid hypochlorites (e.g., HTH, STB, and Dutch powder) are also effective in destroying GV-series agents. Reaction with hypochlorites, including household bleach, may produce toxic gases such as chlorine.

Although specific data has not been published in the unclassified literature, preliminary studies indicate reactive skin decontaminant Lotion (RSDL) containing aqueous solutions of oxime salts, Sandia decontamination foam formulations containing high pH aqueous solutions of hydrogen peroxide, Canadian Aqueous System for Chemical-Biological Agent Decontamination (CASCAD) containing aqueous solutions of chloroisocyanurates and complexing agents, as well as Dahlgren decontamination formulations containing aqueous solutions of peracetyl borate and surfactants are all effective at detoxifying GV-series agents.

Novichok Agents

Minimal information on decontamination of novichok agents has been published. However, based on similarities to other organophosphates, it is likely that these agents will be destroyed by high pH (i.e., basic solutions). Use an aqueous caustic solution (minimum of 10% by weight sodium hydroxide or sodium carbonate) or use undiluted household bleach. Hydrolysis of novichok agents will produce acidic by-products so a large excess of base will likely be need to ensure complete destruction of the agents. Due to the extreme volume required, household bleach is not an efficient means of

decontaminating large quantities of these agents. Basic peroxides (e.g., a solution of baking soda, 30 to 50% hydrogen peroxide and an alcohol) will likely also detoxify novichok agents.

Solid hypochlorites (e.g., HTH, STB, and Dutch powder) are also effective in destroying novichok agents. Reaction with hypochlorites, including household bleach, may produce toxic gases such as chlorine.

Reactive skin decontaminant lotion (RSDL) containing aqueous solutions of oxime salts is effective at detoxifying novichok agents. Although specific data has not been published in the unclassified literature, preliminary studies indicate that Sandia decontamination foam formulations containing high pH aqueous solutions of hydrogen peroxide, Canadian Aqueous System for Chemical-Biological Agent Decontamination (CASCAD) containing aqueous solutions of chloroisocyanurates and complexing agents, as well as Dahlgren decontamination formulations containing aqueous solutions of peracetyl borate and surfactants are all effective at detoxifying novichok agents.

Oxime-Series Agents

Information on decontaminating oxime-series agents has not been published. However, based on similarities to other organophosphates, it is likely that these agents will be destroyed by high pH (i.e., basic solutions). Use an aqueous caustic solution (minimum of 10% by weight sodium hydroxide or sodium carbonate) or use undiluted household bleach. Hydrolysis of oxime-series agents will produce acidic by-products so a large excess of base will likely be need to ensure complete destruction of the agents. Due to the extreme volume required, household bleach is not an efficient means of decontaminating large quantities of these agents. Basic peroxides (e.g., a solution of baking soda, 30 to 50% hydrogen peroxide and an alcohol) will likely also detoxify oxime-series agents.

Solid hypochlorites (e.g., HTH, STB, and Dutch powder) should also be effective in destroying oxime-series nerve agents. Reaction with hypochlorites, including household bleach, may produce toxic gases such as chlorine.

Although specific data has not been published in the unclassified literature, preliminary studies indicate that reactive skin decontaminant lotion (RSDL) containing aqueous solutions of oxime salts, Sandia decontamination foam formulations containing high pH aqueous solutions of hydrogen peroxide, Canadian Aqueous System for Chemical-Biological Agent Decontamination (CASCAD) containing aqueous solutions of chloroisocyanurates and complexing agents, as well as Dahlgren decontamination formulations containing aqueous solutions of peracetyl borate and surfactants are all effective at detoxifying oxime-series agents.

Vapors

Casualties/personnel

Remove all clothing as it may continue to emit trapped agent vapor after contact with the vapor cloud has ceased. Shower using copious amounts of soap and water. Ideally, showers will be high volume with low pressure. Ensure that the hair has been washed and rinsed to remove potentially trapped vapor. If there is a potential that the eyes have been exposed to nerve agents, irrigate with water or 0.9% saline solution for a minimum of 15 minutes.

Small areas

Ventilate to remove the vapors. If condensation is present, decontaminate with copious amounts of a decontamination solution described in the general section above. Collect and place into containers lined with high-density polyethylene. Wash the area with copious amounts of soap and water. Collect and containerize the rinseate. Removal of porous material, including painted surfaces, may be required because nerve agent that has been absorbed into these materials can migrate back to the surface posing both a contact and vapor hazard.

Liquids, Solutions, or Liquid Aerosols

Casualties/personnel

Cover all open wounds during the decontamination process. Remove all clothing immediately. Even clothing that has not come into direct contact with the agent may contain trapped vapor. To avoid further exposure of the head, neck and face to the agent, cut off potentially contaminated clothing that must be pulled over the head. Remove as much of the nerve agent from the skin as fast as possible. If water is not immediately available, the agent can be absorbed with any convenient material such as paper towels, toilet paper, flour, talc, etc. To minimize both spreading the agent and abrading the skin, blot the contaminated skin and do not rub the agent with the absorbent. If reactive skin decontaminant lotion (RSDL) is available, it should be used for topical spot decontamination.

Use a sponge or cloth with liquid soap and copious amounts of water to wash the skin surface and hair at least three times. Ideally, showers will be high volume with low pressure. Do not delay decontamination to find warm or hot water if it is not readily available. Avoid rough scrubbing as this could abrade the skin and increase percutaneous absorption of residual agent. Rinse with copious amounts of water. If there is a potential that the eyes have been exposed to nerve agents, irrigate with water or 0.9% saline solution for a minimum of 15 minutes.

Although the CDC does not recommend the use of hypochlorite bleach directly on skin for decontamination, the military still recognizes household bleach as an effective alternative to soap and water. The bleach solution should be no more than 0.5% sodium hypochlorite (i.e., no more than one-part household bleach in nine-parts water) to avoid damaging the skin. Avoid any contact with sensitive areas such as the eyes. Rinse with copious amounts of water.

If individuals have been exposed to novichok agents, decontamination may need to be repeated over the course of up to three days due to a depot effect the agents have in skin. Responders/caregivers should take appropriate measures to prevent direct contact with secretions and body fluids as they may contain these agents.

Small areas

Ventilate to remove the aerosol. Puddles of liquid can be absorbed by covering with absorbent material such as vermiculite, diatomaceous earth, clay, sponges, or towels. Place the absorbed material into containers lined with high-density polyethylene. Before sealing the container, cover the contents with a decontamination solution described in the general section above. Decontaminate the area and the exterior of the container with copious amounts of the neutralizing agent. Allow it to stand for a minimum of 5minutes before rinsing with water. Collect and containerize the rinseate. Ventilate the area to remove residual vapors. Removal of porous material, including painted surfaces, may be required because nerve agent that has been absorbed into these materials can migrate back to the surface posing both a contact and vapor hazard.

Solids, Dusty Agents, or Particulate Aerosols

Casualties/personnel

Cover all open wounds during the decontamination process. Do not attempt to brush the agent off of the individual or their clothing as this can aerosolized the agent. If possible, dampen the agent with a water mist to help prevent aerosolization. Remove all clothing immediately. To avoid further exposure of the head, neck and face to the agent, cut off potentially contaminated clothing that must be pulled over the head. Use a sponge or cloth with liquid soap and copious amounts of water to wash the skin surface and hair at least three times. Ideally, showers will be high volume with low pressure. Do not delay decontamination to find warm or hot water if it is not readily available. Rinse with copious amounts of water. If there is a potential that the eyes have been exposed to nerve agents, irrigate with water or 0.9% saline solution for a minimum of 15 minutes.

If individuals have been exposed to novichok agents, decontamination may need to be repeated over the course of up to three days due to a depot effect the agents have in skin. Responders/caregivers should take appropriate measures to prevent direct contact with secretions and body fluids as they may contain these agents.

Small areas

If indoors, close windows and doors in the area and turn off anything that could create air currents (e.g., fans, air conditioner, etc.). Allow aerosol to settle. Avoid actions that could aerosolize the agent such as sweeping or brushing. Collected the agent with a vacuum cleaner equipped with a high-efficiency particulate air (HEPA) filter. Do not use a standard home or industrial vacuum. Do not allow the vacuum exhaust to stir the air in the contaminated area. Vacuum all surfaces with extreme care in a very slow and controlled manner to minimize aerosolizing the agent. Place the collected material into containers lined with high-density polyethylene. Before sealing the container, cover the contents with a decontamination solution described in the general section above. Decontaminate the area with copious amounts of the neutralizing agent. Allow it to stand for a minimum of 5minutes before rinsing with water. Collect and containerize the rinseate.

MEDICAL

CDC Case Definition

1) A case in which nerve agents are detected in the urine. Decreased plasma or red blood cell cholinesterase levels based on a specific commercial laboratory reference range might indicate a nerve agent or organophosphate exposure; however, the normal range levels for cholinesterase are wide, which makes interpretation of levels difficult without a baseline measurement or repeat measurements over time. OR 2) Detection of organophosphates in environmental samples. The case can be confirmed if laboratory testing is not performed by either the presence of a predominant amount of clinical and nonspecific laboratory evidence or an absolute certainty of the etiology of the agent.

Differential Diagnosis

The following factors have been suggested as alternatives to consider when presented with a potential case of exposure to nerve agents: carbamate and organophosphate pesticides; alkaloids such as nicotine or coniine; ingestion of mushrooms containing muscarine; and medicinals such as carbamates, cholinomimetic compounds and neuromuscular blocking drugs.

Signs and Symptoms

Vapors/Aerosols

Pinpointing of pupils (miosis) and extreme nasal discharge (rhinorrhea) may be the first indications of exposure. Miosis usually indicates exposure to vapors or aerosols unless the individual has had liquid agent in or around their eyes. The casualty may also experience difficulty breathing with a feeling of shortness of breath or tightness of the chest. In cases of exposure to high vapor concentrations, the gastrointestinal tract may be affected producing vomiting, urination, or defecation. Inhalation of lethal amounts of nerve agent can cause loss of consciousness and convulsions in as little as 30 seconds, followed by cessation of breathing and flaccid paralysis after several more minutes.

In contrast to either the G-series or V-series agents, the observable signs and symptoms of exposure to the GV-series agents are more insidious and tend to be very mild and transient. Even convulsions occurring just prior to death are usually milder than with G-series or V-series agents.

In addition, the progression of typical signs and symptoms of exposure to these cholinesterase inhibiting substances may be atypical.

Although present in animal toxicity studies, seizures have not been a significant feature in the limited number of documented human exposures to novichok agents. Bronchoconstriction has also not been observed in these cases.

Liquids/Solids

General signs and symptoms of small to moderate exposure include localized sweating, nausea, vomiting, involuntary urination/defecation, and a feeling of weakness. The casualty may also experience difficulty breathing with a feeling of shortness of breath or tightness of the chest. Vomiting and uncontrolled urination/defecation generally indicates an exposure to liquid or solid agent and not just agent vapors. Miosis usually does not occur unless the individual has had agent in or around their eyes. Exposure to a large amount of agent causes copious secretions, loss of consciousness, convulsions progressing into flaccid paralysis, and cessation of breathing.

In contrast to either the G-series or V-series agents, the observable signs and symptoms of exposure to the GV-series agents are more insidious and tend to be very mild and transient. Even convulsions occurring just prior to death are usually milder than with G-series or V-series agents. In addition, the progression of typical signs and symptoms of exposure to these cholinesterase inhibiting substances may be atypical.

In general, the latent period for onset of symptoms from exposure to novichok agents is longer than for other nerve agents — extending up to three days. Larger exposures will have shorter latent periods. Although present in animal toxicity studies, seizures have not been a significant feature in the limited number of documented human exposures to these agents. Bronchoconstriction has also not been observed in these cases.

Mass-Casualty Triage Recommendations

Priority 1

A casualty with symptoms in two or more organ systems (not including miosis or rhinorrhea), who has a heartbeat and a palpable blood pressure. The casualty may or may not be conscious and/or breathing.

Priority 2

A casualty with a known exposed to liquid agent but no apparent signs or symptoms; OR a casualty who is recovering from a severe exposure after receiving treatment.

Priority 3

A casualty who is walking and talking, although miosis and/or rhinorrhea may be present.

Priority 4

A casualty who is not breathing and does not have a heartbeat or palpable blood pressure.

Casualty Management

Decontaminate the casualty ensuring that all nerve agent has been removed. If nerve agents have gotten into the eyes, irrigate the eyes with water or 0.9% saline solution for at least 15 minutes. Irrigate open wounds with water or 0.9% saline solution for at least 10 minutes. However, do not delay treatment if thorough decontamination cannot be undertaken immediately.

Once the casualty has been decontaminated, including the removal of foreign matter from wounds, medical personnel do not need to wear a chemical-protective mask.

Ventilate the patient. There may be an increase in airway resistance due to constriction of the airway and the presence of secretions. If breathing is difficult, administer oxygen. As soon as possible administer atropine alone or in combination with pralidoxime chloride (2-PAM Cl) or another appropriate oxime. Diazepam may be required to prevent and/or control severe convulsions. If diazepam is not administered within 40 minutes post-exposure, then its effectiveness at controlling seizures is minimal.

Over time, the nerve agent enzyme complex undergoes an irreversible biochemical decomposition known as aging. After aging occurs, the nerve agent molecule can no longer be removed from the enzyme by treatment with an oxime. The rate of aging is dependent on the chemical structure of the specific nerve agent and ranges from several minutes to several days. Soman (C01-A003) ages in approximately 2minutes, making treatment for exposure to this particular agent difficult. The Former Soviet Union is reported to have developed other agents that age rapidly, but the specific agents have not been identified in unclassified literature.

Due to a depot effect, decontamination of individuals exposed to novichok agents may need to be repeated over the course of up to three days. Caregivers should take appropriate measures to prevent direct contact with secretions and body fluids as they may contain these agents. Casualties exposed to these agents may also require more aggressive supportive care including repeated administration of larger doses of medications over a longer duration.

FATALITY MANAGEMENT

Remove all clothing and personal effects segregating them as either durable or non-durable items. While it may be possible to decontaminate durable items, it may be safer and more efficient to destroy non-durable items rather than attempt to decontaminate them. Items that will be retained for further processing should be double sealed in impermeable containers, ensuring that the inner container is decontaminated before placing it in the outer one.

For fatalities resulting from exposure to novichok agents, there are concerns that these agents can persist in blood and body fluids. Wear appropriate respiratory and dermal protective clothing and process these materials as a high-hazard waste. Otherwise, nerve agents that have entered the body are metabolized, hydrolyzed or bound to tissue and pose little threat of off-gasing.

To remove agents on the outside of the body, wear appropriate respiratory and dermal protective clothing while washing the remains with a 2% sodium hypochlorite bleach solution (i.e., 2 liters of water for every liter of household bleach), ensuring the solution is introduced into the ears, nostrils, mouth, and any wounds. This concentration of bleach will not affect remains but will neutralize organophosphorus nerve agents. Higher concentrations of bleach can harm remains. Pay particular attention to areas where agent may get trapped, such as hair, scalp, pubic areas, fingernails, folds of skin, and wounds. The bleach solution should remain on the cadaver for a minimum of 15 minutes. Wash with soap and water. Ensure that all the bleach solution is removed prior to embalming as it will react with embalming fluid. All wash and rinse waste must be contained for proper disposal. Screen the remains for agent vapors and residual liquid at the conclusion of the decontamination process.

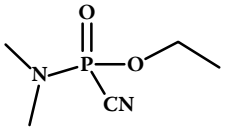
If the remains must be stored before embalming, then place them inside body bags designed to contain contaminated bodies or in double body bags. If double body bags are used, seal the inner bag with duct tape, rinse, then place in the second bag. After embalming is complete, place the remains in body bags designed to contain contaminated bodies or in double body bags. Other than for fatalities resulting from novichok agents or events where the body was saturated with VX (C01-A017), body fluids removed during the embalming process do not pose any additional risks and should be contained and handled according to established procedures. High-risk wastes should only be handled by individuals wearing appropriate protective equipment, and should be collected and containerized for appropriate disposal.

Standard burials are acceptable when contamination levels are low enough to allow bodies to be handled without wearing additional protective equipment. Cremation may be required if remains cannot be completely decontaminated. Although organophosphorus nerve agents are destroyed after 15 minutes at the operating temperature of a commercial crematorium (i.e., above 1,000°F), the initial heating phase may volatilize some of the agent and allow vapors to escape.

C01-A G-SERIES AGENTS

C01-A001

Tabun (Agent GA)
CAS: 77-81-6
RTECS: TB4550000
UN: —
EC: —
UNII: S45M750QSH
ICD-11: —



$C_5\ H_{11}\ N_2\ O_2\ P$

Colorless to brown liquid that is odorless when pure; impurities may give a faintly fruity or bitter almonds odor. Undergoes considerable decomposition when explosively disseminated.

This material is on Schedule 1 of the CWC.

Exposure Hazards
Conversion Factor: 1 ppm = 6.63 mg/m^3 at 77°F
$LCt_{50\ (Inh)}$: 70 mg-min/m^3 (5 ppm for a 2-minute exposure)
$LCt_{50\ (Per)}$: 15,000 mg-min/m^3 (2 ppm for a 30-minute exposure)
LD_{50}: 1 g
Miosis: 0.03 ppm for a 2-minute exposure
$MEG_{(1hr)}$: Neg: 0.00042 ppm; Mar: 0.0087 ppm; Crit: 0.014 ppm; Cat: 0.69 ppm
PAC-1: 0.00042 ppm; *PAC-2:* 0.0053 ppm; *PAC-3:* 0.039 ppm
WPL AEL: 5×10^{-6} ppm
GPL AEL: 2×10^{-7} ppm
$STEL_{(CDC)}$: 2×10^{-5} ppm
IDLH: 0.01 ppm

Final AEGLs
AEGL-1: 1 hr – 0.00042 ppm; 4 hr – 0.00021 ppm; 8 hr – 0.00015 ppm
AEGL-2: 1 hr – 0.0053 ppm; 4 hr – 0.0026 ppm; 8 hr – 0.0020 ppm
AEGL-3: 1 hr – 0.039 ppm; 4 hr – 0.021 ppm; 8 hr – 0.015 ppm

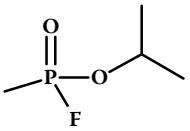
Properties:

MW: 162.1	*VP:* 0.037 mmHg	*FlP:* 172°F
D: 1.1 g/mL (77°F)	*VD:* 5.6	*LEL:* —

MP: –58°F	*Vlt:* 49 ppm	*UEL*: —
BP: 473°F	*ER:* —	*RP:* 210
Vsc: 2.2 cs (77°F)	H_2O: 7.2%	*IP:* <10.6 eV
	Sol: Most organic solvents	

C01-A002

Sarin (Agent GB)
CAS: 107-44-8
RTECS: TA8400000
UN: —
EC: —
UNII: B4XG72QGFM
ICD-11: —



C_4 H_{10} F O_2 P

Colorless liquid that is odorless when pure.

This material is on Schedule 1 of the CWC.

Also reported stockpiled as a mixture with cyclosarin (C01-A005).

Exposure Hazards
Conversion Factor: 1 ppm = 5.73 mg/m^3 at 77°F
$LCt_{50\ (Inh)}$: 35 mg-min/m^3 (3 ppm for a 2-minute exposure)
$LCt_{50\ (Per)}$: 12,000 mg-min/m^3 (1 ppm for a 30-minute exposure)
LD_{50}: 1.7 g
Miosis: 0.03 ppm for a 2-minute exposure.
$MEG_{(1hr)}$: Neg: 0.00049 ppm; Mar: 0.010 ppm; Crit: 0.016 ppm; Cat: 0.40 ppm
PAC-1: 0.00047 ppm; *PAC-2:* 0.0059 ppm; *PAC-3:* 0.023 ppm
WPL AEL: 5×10^{-6} ppm
GPL AEL: 2×10^{-7} ppm
$STEL_{(CDC)}$: 2×10^{-5} ppm
IDLH: 0.02 ppm

Final AEGLs
AEGL-1: 1 hr – 0.00048 ppm; 4 hr – 0.00024 ppm; 8 hr – 0.00017 ppm
AEGL-2: 1 hr – 0.0060 ppm; 4 hr – 0.0029 ppm; 8 hr – 0.0022 ppm
AEGL-3: 1 hr – 0.022 ppm; 4 hr – 0.012 ppm; 8 hr – 0.0087 ppm

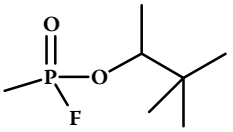
Properties:

MW: 140.1	*VP:* 2.9 mmHg (77°F)	*FlP:* NA
D: 1.1 g/mL	*VD:* 4.8	*LEL:* NA
MP: –69°F	*Vlt:* 2,800 ppm	*UEL*: NA

BP: 316°F	*ER:* —	*RP:* 3
Vsc: 1.3 cs (77°F)	*H_2O:* Miscible	*IP:* 10.26 eV (est.)
	Sol: Most organic solvents	

C01-A003

Soman (Agent GD)
CAS: 96-64-0
RTECS: TA8750000
UN: —
EC: —
UNII: 3OF3WXB67Q
ICD-11: —



$C_7\ H_{16}\ F\ O_2\ P$

Colorless to brown liquid that is relatively odorless when pure; impurities may give a fruity or camphor odor.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Conversion Factor: 1 ppm = 7.45 mg/m^3 at 77°F

This agent ages rapidly in the body becoming refractory to the antidote.

$LCt_{50\ (Inh)}$: 35 mg-min/m^3 (2.3 ppm for a 2-minute exposure)
$LCt_{50\ (Per)}$: 3,000 mg-min/m^3 (0.2 ppm for a 30-minute exposure)
LD_{50}: 0.35 g
Miosis: 0.01 ppm for a 2-minute exposure
$MEG_{(1hr)}$: Neg: 0.00019 ppm; Mar: 0.0034 ppm; Crit: 0.0050 ppm; Cat: 0.31 ppm
PAC-1: 0.00017 ppm; *PAC-2:* 0.0021 ppm; *PAC-3:* 0.017 ppm
WPL AEL: 4×10^{-6} ppm
GPL AEL: 1×10^{-7} ppm
$STEL_{(CDC)}$: 7×10^{-6} ppm
IDLH: 0.007 ppm

Final AEGLs
AEGL-1: 1 hr – 0.00018 ppm; 4 hr – 0.000091 ppm; 8 hr – 0.000065 ppm
AEGL-2: 1 hr – 0.0022 ppm; 4 hr – 0.0012 ppm; 8 hr – 0.00085 ppm
AEGL-3: 1 hr – 0.017 ppm; 4 hr – 0.0091 ppm; 8 hr – 0.0066 ppm

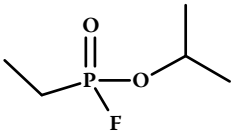
Properties:

MW: 182.2	*VP:* 0.40 mmHg (77°F)	*FlP:* 250°F
D: 1.0 g/mL (77°F)	*VD:* 6.2	*LEL:* —
MP: –44°F	*Vlt:* 520 ppm	*UEL:* —

BP: 388°F	*ER:* —	*RP:* 19 (77°F)
Vsc: 3.1 cs (77°F)	*H_2O:* 2.1%	*IP:* <10.6 eV
	Sol: Hydrocarbons, alcohols	

C01-A004

Ethyl Sarin (Agent GE)
CAS: 1189-87-3
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_5\ H_{12}\ F\ O_2\ P$

Specific information is not available for this agent.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Conversion Factor: 1 ppm = 6.30 mg/m^3 at 77°F

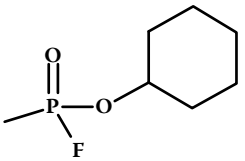
Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be approximately 90% as toxic as sarin (C01-A002).

Properties:

MW: 154.1	*VP:* —	*FlP:* —
D: —	*VD:* 5.3	*LEL:* —
MP: —	*Vlt:* —	*UEL:* —
BP: 165°F (16 mmHg)	*ER:* —	*RP:* —
Vsc: —	*H_2O:* —	*IP:* —
	Sol: —	

C01-A005

Cyclosarin (Agent GF)
CAS: 329-99-7
RTECS: —
UN: —
EC: —
UNII: VM36F9N236
ICD-11: —



$C_7\ H_{14}\ F\ O_2\ P$

Clear, colorless liquid that is odorless.

This material is on Schedule 1 of the CWC.

Also reported stockpiled as a mixture with Sarin (C01-A002).

Exposure Hazards

Conversion Factor: 1 ppm = 7.37 mg/m^3 at 77°F
$LCt_{50\ (Inh)}$: 35 mg-min/m^3 (2 ppm for a 2-minute exposure)
$LCt_{50\ (Per)}$: 3,000 mg-min/m^3 (0.2 ppm for a 30-minute exposure)
LD_{50}: 0.35 g
Miosis: 0.03 ppm for a 2-minute exposure
$MEG_{(1hr)}$: Neg: 0.00019 ppm; Mar: 0.0031 ppm; Crit: 0.0050 ppm; Cat: 0.31 ppm
PAC-1: 0.00020 ppm; *PAC-2:* 0.0024 ppm; *PAC-3:* 0.018 ppm
WPL AEL: 4×10^{-6} ppm
GPL AEL: 1×10^{-7} ppm
$STEL_{(CDC)}$: 7×10^{-6} ppm
IDLH: 0.007 ppm

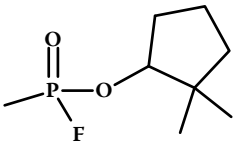
Final AEGLs
AEGL-1: 1 hr – 0.00020 ppm; 4 hr – 0.00010 ppm; 8 hr – 0.000070 ppm
AEGL-2: 1 hr – 0.0024 ppm; 4 hr – 0.0013 ppm; 8 hr – 0.00091 ppm
AEGL-3: 1 hr – 0.018 ppm; 4 hr – 0.0098 ppm; 8 hr – 0.0071 ppm

Properties:

MW: 180.2	*VP:* 0.044 mmHg	*FlP:* 201°F
D: 1.1 g/mL	*VD:* 6.2	*LEL:* —
MP: 10°F	*Vlt:* 59 ppm	*UEL:* —
BP: 462°F	*ER:* —	*RP:* 110
Vsc: 4.3 cs (77°F)	*H_2O:* 3.7%	*IP:* <10.6 eV
	Sol: Most organic solvents	

C01-A006

2,2-Dimethylcyclopentyl Methylphosphonofluoridate (Agent GP)
CAS: 453574-97-5
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_8 H_{16} F O_2 P$

Liquid. Other descriptive information has not been published.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Conversion Factor: 1 ppm = 7.94 mg/m^3 at 77°F

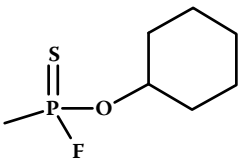
Human toxicity values have not been established or have not been published. However, this agent is a powerful cholinesterase inhibitor.

Properties:

MW: 194.2	*VP:* 0.09422 mmHg (77°F)	*FlP:* 199°F
D: 1.1 gm/ml	*VD:* 6.7	*LEL:* —
MP: – 11°F (est.)	*Vlt:* 124 ppm (77°F)	*UEL*: —
BP: 432°F	*ER:* —	*RP:* 77
Vsc: 4.7 cS (77°F)	*H_2O:* —	*IP:* —
	Sol: —	

C01-A007

O-Cyclohexyl Methylphosphonofluoridothiate (Agent EA 2223)
CAS: 4241-34-3
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_7 H_{14} F O P S$

Water-white to yellow liquid that is odorless.

This material is on Schedule 2 of the CWC.

This agent will hydrolyze to produce cyclosarin (C01-A005).

Exposure Hazards

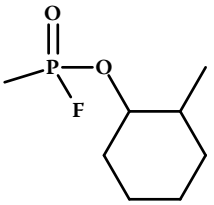
Conversion Factor: 1 ppm = 8.02 mg/m^3 at 77°F
This agent is refractory to treatment.
$LCt_{50\ (Inh)}$: 100 mg-min/m^3 (6 ppm for a 2-minute exposure)
LD_{50}: 0.18 g

Properties:

MW: 196.2	*VP:* 0.12 mmHg (77°F)	*FlP:* 234°F
D: 1.1 g/mL (77°F)	*VD:* 6.8	*LEL:* —
MP: –16°F	*Vlt:* 155 ppm	*UEL:* —
BP: 441°F	*ER:* —	*RP:* 60
Vsc: 3.5 cs (77°F)	*H_2O:* Insoluble	*IP:* —
	Sol: Most organic solvents	

C01-A008

2-Methylcyclohexyl Methylphosphonofluoridate (Agent EA 1356 or Agent EA 3534)
CAS: 85473-32-1; 193090-56-1 (Isomer); 193090-30-1 (Isomer)
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



C_8 H_{16} F O_2 P

Water-white to light straw-colored liquid that is odorless. There are two configurational isomers of this agent that have been studied.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Conversion Factor: 1 ppm = 7.94 mg/m^3 at 77°F

This agent is refractory to treatment.

$LCt_{50\ (Inh)}$: 70 mg-min/m^3 (4 ppm for a 2-minute exposure)
LD_{50}: 0.17 g

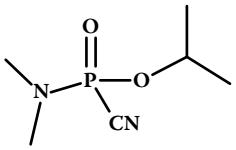
Properties:

MW: 194.2	*VP:* 0.055 mmHg (77°F)	*FlP:* —
D: 1.1g/mL (77°F)	*VD:* 6.7	*LEL:* —
MP: 15°F	*Vlt:* 64 ppm	*UEL:* —
BP: 455°F	*ER:* —	*RP:* 130
Vsc: 4.8 cs (77°F)	*H_2O:* 1%	*IP:* —
	Sol: Most organic solvents	

C01-A009

Isopropyl Dimethylamidocyanidophosphate (Agent EA 4352)
CAS: 63815-55-4
RTECS: —

UN: —
EC: —
UNII: —
ICD-11: —



$C_6\ H_{13}\ N_2\ O_2\ P$

Odorless liquid.

This material is on Schedule 1 of the CWC.

Exposure Hazards

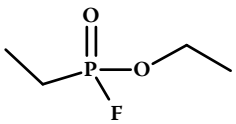
Conversion Factor: 1 ppm = 7.21 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be as toxic as sarin (C01-A002).

Properties:

MW: 176.2	*VP:* 0.055 mmHg (77°F)	*FlP:* —
D: 1.0 g/mL (77°F)	*VD:* 6.1	*LEL:* —
MP: —	*Vlt:* 76 ppm	*UEL*: —
BP: 453°F	*ER:* —	*RP:* 130
Vsc: —	*H_2O:* —	*IP:* —
	Sol: —	

C01-A010
Ethyl Ethylphosphonofluoridate
CAS: 650-20-4
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_4\ H_{10}\ F\ O_2\ P$

Specific information is not available for this agent.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Conversion Factor: 1 ppm = 5.73 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published. However, this agent is a powerful cholinesterase inhibitor.

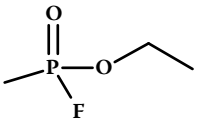
Properties:

MW: 140.1	*VP:* —	*FlP:* —
D: —	*VD:* 4.8	*LEL:* —
MP: —	*Vlt:* —	*UEL:* —
BP: 115°F (9 mmHg)	*ER:* —	*RP:* —
Vsc: —	*H_2O:* —	*IP:* —
	Sol: —	

C01-A011

Ethyl Methylphosphonofluoridate

CAS: 673-97-2
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



C_3 H_8 F O_2 P

Specific information is not available for this agent.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Conversion Factor: 1 ppm = 5.16 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published. However, this agent is a powerful cholinesterase inhibitor.

Properties:

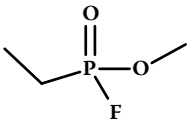
MW: 126.1	*VP:* —	*FlP:* —
D: —	*VD:* 4.3	*LEL:* —
MP: —	*Vlt:* —	*UEL:* —
BP: 127°F (12 mmHg)	*ER:* —	*RP:* —
Vsc: —	*H_2O:* —	*IP:* —
	Sol: —	

C01-A012

Methyl Ethylphosphonofluoridate

CAS: 665-03-2
RTECS: —
UN: —
EC: —

UNII: —
ICD-11: —



$C_3\ H_8\ F\ O_2\ P$

Specific information is not available for this agent.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Conversion Factor: 1 ppm = 5.16 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published. However, this agent is a powerful cholinesterase inhibitor.

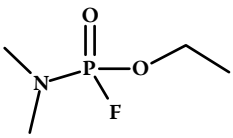
Properties:

MW: 126.1	*VP:* —	*FlP:* —
D: —	*VD:* 4.3	*LEL:* —
MP: —	*Vlt:* —	*UEL:* —
BP: 117°F (12 mmHg)	*H_2O:* —	*RP:* —
Vsc: —	*Sol:* —	*IP:* —

C01-A013

Fluorotabun

CAS: 358-29-2
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_4\ H_{11}\ F\ N\ O_2\ P$

Specific information is not available for this agent.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Conversion Factor: 1 ppm = 6.34 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be less than half as toxic as tabun (C01-A001).

Properties:

MW: 155.1	*VP:* —	*FlP:* —
D: —	*VD:* 5.3	*LEL:* —
MP: —	*Vlt:* —	*UEL:* —
BP: 167°F (18 mmHg)	*ER:* —	*RP:* —
Vsc: —	H_2O: —	*IP:* —
	Sol: —	

V-SERIES AGENTS

C01-A014

Amiton (Agent VG)

CAS: 78-53-5; 3734-96-1 (p-Toluenesulfonate salt); 3734-97-2 (Oxalate salt)

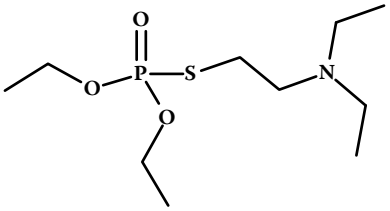
RTECS: —

UN: —

EC: —

UNII: 7SD1SH009V; E667O600B2 (Oxalate salt)

ICD-11: —



C_{10} H_{24} N O_3 P S

Oily liquid. Various salts (solids) have been reported.

This material is on Schedule 2 of the CWC.

Exposure Hazards

Conversion Factor: 1 ppm = 11.01 mg/m^3 at 77°F

$MEG_{(1hr)}$: Neg: 2.0 mg/m^3; Mar: —; Crit: 3.3 mg/m^3; Cat: —

PAC-1: 0.0099 mg/m^3; *PAC-2:* 0.11 mg/m^3; *PAC-3:* 0.65 mg/m^3

Properties:

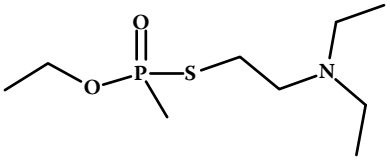
MW: 269.3	*VP:* 0.01 mmHg (176°F)	*FlP:* —
D: —	*VD:* 9.3	*LEL:* —
MP: —	*Vlt:* 11 ppm	*UEL:* —
BP: 230°F (0.2 mmHg)	*ER:* —	*RP:* 730 (176°F)
Vsc: —	H_2O: Soluble	*IP:* —
	Sol: Most organic solvents	

Oxalate Salt
MW: 359.4
MP: 190°F

p-Toluenesulfonate Salt
MW: 441.5
MP: 205°F

C01-A015

O-Ethyl S-(2-Diethylaminoethyl) Methyl-phosphonothiolate (Agent VM)
CAS: 21770-86-5; 107059-49-4 (p-Toluenesulfonate salt)
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_9\ H_{22}\ N\ O_2\ P\ S$

Water-white to dark-yellow, oily liquid that is odorless. Various salts (solids) have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards
Conversion Factor: 1 ppm = 9.79 mg/m^3 at 77°F
$LCt_{50\ (Inh)}$: 50 mg-min/m^3 (3 ppm for a 2-minute exposure). This value is for resting individuals.

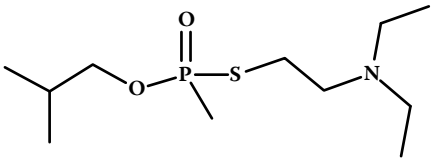
Properties:

MW: 239.3	*VP:* 0.0021 mmHg (77°F)	*FlP:* 457°F
D: 1.0 g/mL (77°F)	*VD:* 8.3	*LEL:* —
MP: −58°F	*Vlt:* 2.9 ppm	*UEL*: —
BP: ~560°F	*ER:* —	*RP:* 3,100
Vsc: 5.7cs (77°F)	*H_2O:* Miscible	*IP:* <10.6 eV
	Sol: Most organic solvents, dilute mineral acids	

p-Toluenesulfonate Salt
MW: 411.5
MP: 147°F

C01-A016

O-Isobutyl S-2-Diethylaminoethyl Methylphosphonothiolate (Agent VR)
CAS: 159939-87-4
RTECS: —
UN: —
EC: —
UNII: LG34LSI9IU
ICD-11: —



C_{11} H_{26} N O_2 P S

Specific information is not available for this agent. Various salts (solids) have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Conversion Factor: 1 ppm = 10.94 mg/m^3 at 77°F

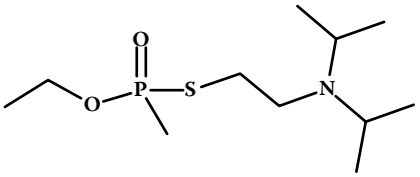
Human toxicity values have not been established or have not been published. However, this agent is a powerful cholinesterase inhibitor.

Properties:

MW: 267.4	*VP:* 6.2 × 10^{-4} mmHg (77°F)	*FlP:* —
D: 1.0 g/mL	*VD:* 9.0	*LEL:* —
MP: —	*Vlt:* 0.81 ppm	*UEL*: —
BP: 187°F (0.001 mmHg)	*ER:* —	*RP:* 9,900
Vsc: —	*H_2O:* —	*IP:* 7.49 eV (est.)
	Sol: —	

C01-A017

O-Ethyl S-(2-Diisopropylaminoethyl) Methylphosphonothiolate (Agent VX)
CAS: 50782-69-9; 65167-63-7 (Isomer); 65167-64-8 (Isomer)
RTECS: TB1090000
UN: —
EC: —
UNII: —
ICD-11: —



C_{11} H_{26} N O_2 P S

Colorless, oily liquid that is odorless. Similar in appearance to motor oil. Various salts (solids) have been reported.

This material is on Schedule 1 of the CWC.

Frequently ignites when disseminated from an artillery shell.

Exposure Hazards

Conversion Factor: 1 ppm = 10.94 mg/m^3 at 77°F
$LCt_{50\ (Inh)}$: 15 mg-min/m^3 (0.7 ppm for a 2-minute exposure)
$LCt_{50\ (Per)}$: 150 mg-min/m^3 (0.5 ppm for a 30-minute exposure)

LD_{50}: 0.005 g
Miosis: 5×10^{-3} ppm for a 2-minute exposure
$MEG_{(1hr)}$: Neg: 1.6×10^{-5} ppm; Mar: 4.7×10^{-4} ppm; Crit: 8.2×10^{-4} ppm; Cat: 8.3×10^{-2} ppm
PAC-1: 1.6×10^{-5} ppm; *PAC-2:* 2.7×10^{-4} ppm; *PAC-3:* 9.0×10^{-4} ppm
WPL AEL: 9×10^{-8} ppm
GPL AEL: 5×10^{-8} ppm
$STEL_{(CDC)}$: 9×10^{-7} ppm
IDLH: 3×10^{-4} ppm

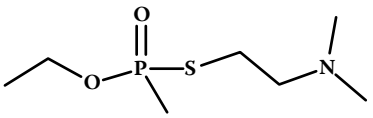
Final AEGLs
AEGL-1: 1 hr – 1.6×10^{-5} ppm; 4 hr – 9.1×10^{-6} ppm; 8 hr – 6.5×10^{-6} ppm
AEGL-2: 1 hr – 2.7×10^{-4} ppm; 4 hr – 1.4×10^{-4} ppm; 8 hr – 9.5×10^{-5} ppm
AEGL-3: 1 hr – 9.1×10^{-4} ppm; 4 hr – 4.8×10^{-4} ppm; 8 hr – 3.5×10^{-4} ppm

Properties:

MW: 267.4	*VP:* 7×10^{-4} mmHg	*FlP:* 318°F
D: 1.0 g/mL (77°F)	*VD:* 9.2	*LEL:* —
MP: –38.2°F	*Vlt:* 1.2 ppm (77°F)	*UEL*: —
MP: <-60°F with impurities	*ER:* —	*RP:* 8,800
BP: Decomposes	*H_2O:* 3% (77°F)	*IP:* 7.09 eV (est.)
Vsc: 1.0 cs (77°F)	*H_2O:* Miscible (<49°F)	
	Sol: Most organic solvents, dilute mineral acids	

C01-A018

O-Ethyl S-2-Dimethylaminoethyl Methylphosphonothiolate (Agent Vx)
CAS: 20820-80-8
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_7\ H_{18}\ N\ O_2\ P\ S$

Amber colored oily liquid that is odorless. Various salts (solids) have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards
Conversion Factor: 1 ppm = 8.64 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.0015 mg/m^3; Mar: 0.013 mg/m^3; Crit: 0.06 mg/m^3; Cat: —
PAC-1: 0.049 mg/m^3; *PAC-2:* 0.54 mg/m^3; *PAC-3:* 3.2 mg/m^3

Properties:

MW: 211.3	*VP:* 0.0042 mmHg	*FlP:* —
D: 1.1 g/mL (77°F)	*VD:* 7.3	*LEL:* —

MP: —	*Vlt:* 5.6 ppm	*UEL*: —
BP: 490°F (approximate)	*ER:* —	*RP:* 1,600
Vsc: —	*H_2O:* Slight, miscible at cooler temperatures	*IP:* <10.6 eV
	Sol: Most organic solvents	

C01-A019

O-Cyclopentyl S-(2-Diethylaminoethly) Methylphosphonothiolate (Agent EA 3148)

CAS: 93240-66-5

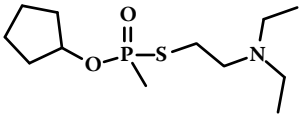
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



C_{12} H_{26} N O_2 P S

Colorless to pale yellow liquid that is odorless.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Conversion Factor: 1 ppm = 11.43 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published. However, this agent is a powerful cholinesterase inhibitor.

Properties:

MW: 279.4	*VP:* 4×10^{-4} mmHg (77°F)	*FlP:* >500°F
D: 1.1 g/mL (77°F)	*VD:* 9.6	*LEL:* —
MP: —	*Vlt:* 0.5 ppm (77°F)	*UEL*: —
BP: 232°F (0.05 mmHg)	*ER:* —	*RP:* 15,000
Vsc: 2.0 cs (77°F)	*H_2O:* Low	*IP:* —
	Sol: Most organic solvents	

C01-A020

O-Cyclopentyl S-(2-Diisopropylaminoethyl) Methylphosphonothiolate (Agent EA 3317)

CAS: 85473-33-2; 102490-57-3 (Isomer); 102490-59-5 (Isomer)

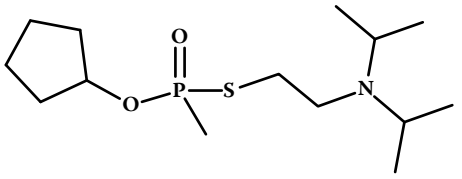
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



C_{14} H_{30} N O_2 P S

Odorless liquid.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Conversion Factor: 1 ppm = 12.57 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published. However, this agent is a powerful cholinesterase inhibitor.

Properties:

MW: 307.4	*VP:* 1.4 × 10^{-4} mmHg (77°F)	*FlP:* —
D: 1.0 g/mL (77°F)	*VD:* 11	*LEL:* —
MP: —	*Vlt:* 0.2 ppm (77°F)	*UEL*: —
BP: 235°F (0.08 mmHg)	*ER:* —	*RP:* 41,000
Vsc: 35 cs	*H_2O:* —	*IP:* —
	Sol: —	

C01-A021

O-Cyclohexyl S-[2-(Diethylamino)ethyl] Methylphosphonothiolate

CAS: 71293-89-5

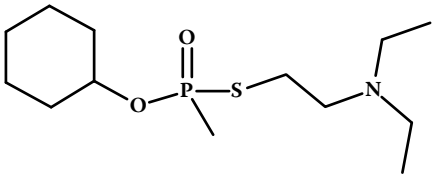
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



C_{13} H_{28} N O_2 P S

Specific information is not available for this agent.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Conversion Factor: 1 ppm = 12.00 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published. However, this agent is a powerful cholinesterase inhibitor.

Properties:

MW: 293.4	*VP:* —	*FlP:* —
D: 0.95 g/mL	*VD:* 10	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 194°F (0.3 mmHg)	*ER:* —	*RP:* —
Vsc: —	*H_2O:* —	*IP:* —
	Sol: —	

C01-A022

O-Ethyl S-[2-(Diethylamino)ethyl] Butylphosphonothiolate

CAS: 100454-47-5; 102180-38-1 (p-Toluenesulfonate salt)

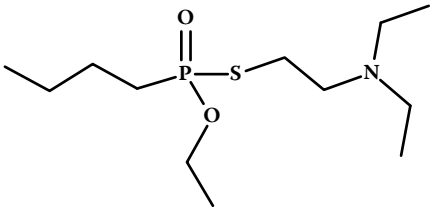
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



C_{12} H_{28} N O_2 P S

Oily liquid. Various salts (solids) have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Conversion Factor: 1 ppm = 11.51 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published. However, this agent is a powerful cholinesterase inhibitor.

Properties:

MW: 281.4	*VP:* —	*FlP:* —
D: —	*VD:* 9.7	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 194°F (0.0025 mmHg)	*ER:* —	*RP:* —
Vsc: —	*H_2O:* —	*IP:* —
	Sol: —	

p-Toluenesulfonate Salt

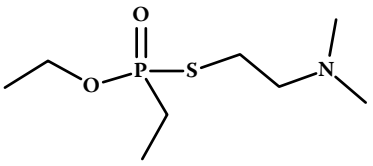
MW: 453.6

MP: 226°F

C01-A023

O-Ethyl S-[2-(Dimethylamino)ethyl] Ethylphosphonothiolate

CAS: 98543-25-0; 110422-92-9 (Oxalate salt)
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_8\ H_{20}\ N\ O_2\ P\ S$

Oily liquid. Various salts (solids) have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Conversion Factor: 1 ppm = 9.21 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published. However, this agent is a powerful cholinesterase inhibitor.

Properties:

MW: 225.3	*VP:* —	*FlP:* —
D: —	*VD:* 7.8	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 167°F (0.005 mmHg)	*ER:* —	*RP:* —
Vsc: —	*H_2O:* —	*IP:* —
	Sol: —	

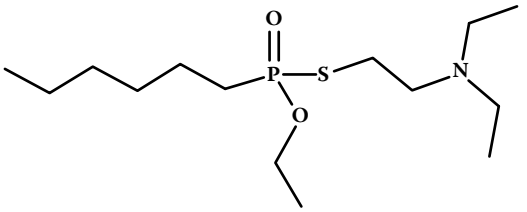
Oxalate Salt

MW: 315.3
MP: 226°F

C01-A024

O-Ethyl S-[2-(diethylamino)ethyl] Hexylphosphonothiolate

CAS: 102444-87-1; 109644-82-8 (Oxalate salt); 102444-88-2 (p-Toluenesulfonate salt)
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



C_{14} H_{32} N O_2 P S

Oily liquid. Various salts (solids) have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Conversion Factor: 1 ppm = 12.66 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published. However, this agent is a powerful cholinesterase inhibitor.

Properties:

MW: 309.5	*VP:* —	*FlP:* —
D: —	*VD:* 11	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 244°F (0.003 mmHg)	*ER:* —	*RP:* —
Vsc: —	*H_2O:* —	*IP:* —
	Sol: —	

Oxalate Salt	**p-Toluenesulfonate Salt**
MW: 399.5	*MW:* 481.7
MP: 185°F	*MP:* 149°F

C01-A025

O-Ethyl-S-[2-(diethylamino)ethyl] Isopropylphosphonothiolate

CAS: 99991-06-7; 101884-85-9 (p-Toluenesulfonate salt)

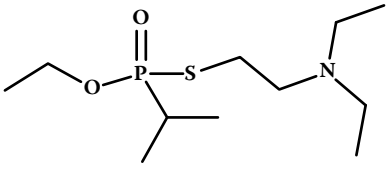
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



C_{11} H_{26} N O_2 P S

Oily liquid. Various salts (solids) have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Conversion Factor: 1 ppm = 10.94 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published. However, this agent is a powerful cholinesterase inhibitor.

Properties:

MW: 267.4	*VP:* —	*FlP:* —
D: —	*VD:* 9.2	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 180°F (0.0007 mmHg)	*ER:* —	*RP:* —
Vsc: —	*H_2O:* —	*IP:* —
	Sol: —	

p-Toluenesulfonate Salt

MW: 439.6

MP: 241°F

C01-A026

O-Ethyl S-[2-(Diethylamino)ethyl] Propylphosphonothiolate

CAS: 99991-07-8; 101884-86-0 (p-Toluenesulfonate salt)

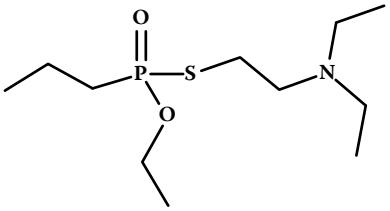
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



C_{11} H_{26} N O_2 P S

Oily liquid. Various salts (solids) have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Conversion Factor: 1 ppm = 10.94 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published. However, this agent is a powerful cholinesterase inhibitor.

Properties:

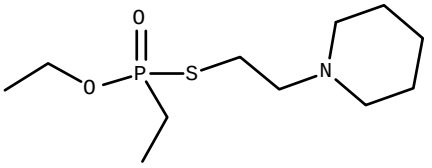
MW: 267.4	*VP:* —	*FlP:* —
D: —	*VD:* 9.2	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —

BP: 212°F (0.015 mmHg)	*ER:* —	*RP:* —
Vsc: —	*H_2O:* —	*IP:* —
	Sol: —	

p-Toluenesulfonate Salt
MW: 439.6
MP: 232°F

C01-A027

O-Ethyl S-[2-(Piperidylamino)ethyl] Ethylphosphonothiolate
CAS: 108753-95-3; 109100-20-1 (Oxalate salt)
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



C_{11} H_{24} N O_2 P S

Oily liquid. Various salts (solids) have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards
Conversion Factor: 1 ppm = 10.85 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published. However, this agent is a powerful cholinesterase inhibitor.

Properties:

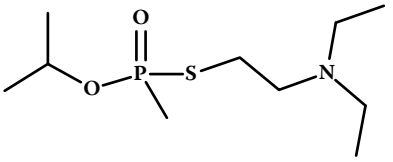
MW: 265.4	*VP:* —	*FlP:* —
D: —	*VD:* 9.2	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 230°F (0.006 mmHg)	*ER:* —	*RP:* —
Vsc: —	*H_2O:* —	*IP:* —
	Sol: —	

Oxalate Salt
MW: 355.4
MP: 264°F

C01-A028

O-Isopropyl S-[2-(Diethylamino)ethyl] Methylphosphonothiolate
CAS: 91134-95-1

RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



C_{10} H_{24} N O_2 P S

Specific information is not available for this agent.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Conversion Factor: 1 ppm = 10.36 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published. However, this agent is a powerful cholinesterase inhibitor.

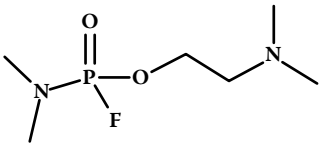
Properties:

MW: 253.3	*VP:* —	*FlP:* —
D: —	*VD:* 8.7	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 250°F (2 mmHg)	*ER:* —	*RP:* —
Vsc: —	*H_2O:* —	*IP:* —
	Sol: —	

GV-SERIES AGENTS

C01-A029

2-Dimethylaminoethyl N,N-Dimethylphosphoramidofluoridate (Agent GV)
CAS: 141102-74-1
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



C_6 H_{16} F N_2 O_2 P

Colorless liquid to white semi-solid depending on purity. Salts are odorless white solids.

Exposure Hazards

Conversion Factor: 1 ppm = 8.15 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be slightly less toxic than VX (C01-A017).

Properties:

MW: 198.2	*VP:* 0.049 mmHg (77°F)	*FlP:* —
D: 1.2 g/mL (77°F)	*VD:* 6.8	*LEL:* —
MP: –166°F	*Vlt:* 64 ppm (77°F)	*UEL*: —
BP: 102°F (0.015 mmHg)	*ER:* —	*RP:* 150 (77°F)
Vsc: —	*H_2O:* Soluble	*IP:* —
	Sol: —	

Methyl Iodide Quaternary Amine Salt

MW: 340.1

MP: 223°F (decomposes)

C01-A030

2-Dimethylaminoethyl N,N-Diethylphosphoramidofluoridate (Agent GV1)

CAS: 141102-75-2

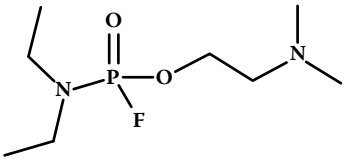
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



C_8 H_{20} F N_2 O_2 P

Specific information is not available for this agent.

Exposure Hazards

Conversion Factor: 1 ppm = 9.25 mg/m^3 at 77°F

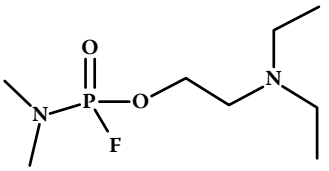
Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be less than one half as toxic as VX (C01-A017).

Properties:

MW: 226.2	*VP:* —	*FlP:* —
D: 1.1 g/mL	*VD:* 7.8	*LEL:* —
MP: –140°F	*Vlt:* —	*UEL*: —
BP: 134°F (0.049 mmHg)	*ER:* —	*RP:* —
Vsc: —	*H_2O:* —	*IP:* —
	Sol: —	

C01-A031

2-Diethylaminoethyl N,N-Dimethylphosphoramidofluoridate (Agent GV2)
CAS: 141102-77-4
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_8\ H_{20}\ F\ N_2\ O_2\ P$

Specific information is not available for this agent.

Exposure Hazards
Conversion Factor: 1 ppm = 9.25 mg/m^3 at 77°F

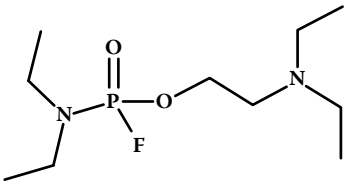
Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be approximately one-tenth as toxic as VX (C01-A017).

Properties:

MW: 226.2	*VP:* —	*FlP:* —
D: 1.0 g/mL	*VD:* 7.8	*LEL:* —
MP: –119°F	*Vlt:* —	*UEL:* —
BP: 127°F (0.002 mmHg)	*ER:* —	*RP:* —
Vsc: —	*H_2O:* —	*IP:* —
	Sol: —	

C01-A032

2-Diethylaminoethyl N,N-Diethylphosphoramidofluoridate (Agent GV3)
CAS: 141102-78-5
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_{10}\ H_{24}\ F\ N_2\ O_2\ P$

Specific information is not available for this agent.

Exposure Hazards

Conversion Factor: 1 ppm = 10.40 mg/m^3 at 77°F

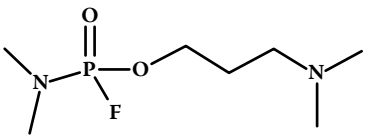
Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be approximately one-twentieth as toxic as VX (C01-A017).

Properties:

MW: 254.3	*VP:* —	*FlP:* —
D: 1.0 g/mL	*VD:* 8.8	*LEL:* —
MP: –132°F	*Vlt:* —	*UEL*: —
BP: 133°F (0.0008 mmHg)	*ER:* —	*RP:* —
Vsc: —	*H_2O:* —	*IP:* —
	Sol: —	

C01-A033

3-Dimethylamionpropyl N,N-Dimethylphosphoramidofluoridate (GV4)
CAS: 158847-17-7
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



C_7 H_{18} F N_2 O_2 P

Liquid. Other descriptive information has not been published.

Exposure Hazards

Conversion Factor: 1 ppm = 6.68 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be approximately one-fifth as toxic as VX (C01-A017).

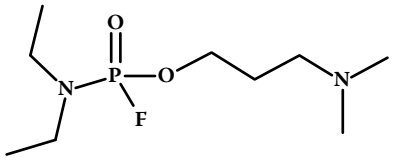
Properties:

MW: 212.2	*VP:* 0.014 mmHg (77°F)	*FlP:* —
D: 1.0 g/mL	*VD:* 7.3	*LEL:* —
MP: –116°F	*Vlt:* 24 ppm (77°F)	*UEL*: —
BP: 435°F	*H_2O:* —	*RP:* 100
Vsc: —	*Sol:* —	*IP:* —

C01-A034

2-Dimethylaminopropyl N,N-Diethylphosphoramidofluoridate (Agent GV5)
CAS: 158847-18-8
RTECS: —
UN: —

EC: —
UNII: —
ICD-11: —



$C_9\ H_{22}\ F\ N_2\ O_2\ P$

Specific information is not available for this agent.

Exposure Hazards

Conversion Factor: 1 ppm = 9.83 mg/m^3 at 77°F

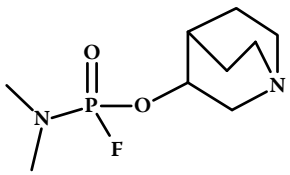
Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be less than one-twentieth as toxic as VX (C01-A017).

Properties:

MW: 240.3	*VP:* —	*FlP:* —
D: 1.0 g/mL	*VD:* 8.3	*LEL:* —
MP: –122°F	*Vlt:* —	*UEL*: —
BP: 136°F (0.034 mmHg)	*ER:* —	*RP:* —
Vsc: —	*H_2O:* —	*IP:* —
	Sol: —	

C01-A035

3-Quinuclidyl N,N-Dimethylphosphoramidofluoridate (Agent EA 5488)
CAS: —
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_9\ H_{18}\ F\ N_2\ O_2\ P$

Liquid. Other descriptive information has not been published.

Exposure Hazards

Conversion Factor: 1 ppm = 9.66 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be less than one half as toxic as VX (C01-A017).

Properties:

MW: 236.3	*VP:* 0.0044 mmHg (77°F)	*FlP:* —
D: —	*VD:* 8.2	*LEL:* —
MP: —	*Vlt:* 5.8 ppm	*UEL*: —
BP: 581°F	*ER:* —	*RP:* 1,500
Vsc: —	*H_2O:* —	*IP:* —
	Sol: —	

NOVICHOK SERIES AGENTS

C01-A036

N,N-Diethyl-N′-[fluoro(methyl)phosphoryl]acetamidine (A-230)

CAS: —

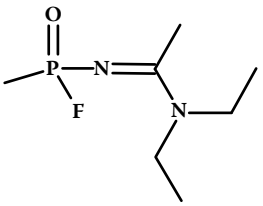
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



C_7 H_{16} F N_2 O P

Liquid. This agent is hydrolyzed approximately 50 times slower than G-series nerve agents. Other specific information is not available for this material. Dimethylformamide is sometimes added to prevents freezing. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Conversion Factor: 1 ppm = 7.94 mg/m^3 at 77°F

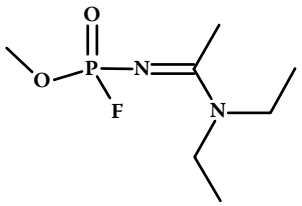
Approximately 5–8 times more toxic than VX (C01-A017), depending on route of exposure.

Properties:

MW: 194.2	*VP:* —	*FlP:* —
D: 1.6 g/mL	*VD:* 6.7	*LEL:* —
MP: 14°F	*Vlt:* —	*UEL*: —
BP: 142°F	*ER:* —	*RP:* —
Vsc: —	*H_2O:* —	*IP:* —
	Sol: —	

C01-A037

N,N-diethyl-N′-[fluoro(methoxy)phosphoryl]acetamidine (A-232)
CAS: —
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_7\ H_{16}\ F\ N_2\ O_2\ P$

Liquid. This agent is hydrolyzed approximately 100 times slower than G-series nerve agents. Other specific information is not available for this material. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

This material is on Schedule 1 of the CWC.

A binary version of this agent (Novichok-5) was developed with components $CH_3PO(F)(CN)$ and N,N-Diethylethanimidamide (C01-C107).

Exposure Hazards

Conversion Factor: 1 ppm = 8.60 mg/m^3 at 77°F

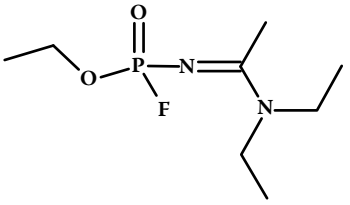
Approximately 5–8 times more toxic than VX (C01-A017), depending on route of exposure.

Properties:

MW: 210.2	*VP:* —	*FlP:* —
D: 1.5 g/mL	*VD:* 7.3	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 158°F	*ER:* —	*RP:* —
Vsc: —	*H_2O:* —	*IP:* —
	Sol: —	

C01-A038

N′-[Ethoxy(fluoro)phosphoryl]-N,N-diethyl-acetamidine (A-234)
CAS: —
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_8\ H_{18}\ F\ N_2\ O_2\ P$

Liquid. This agent is hydrolyzed approximately 2,000 times slower than G-series nerve agents. Other specific information is not available for this material. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

This material is on Schedule 1 of the CWC.

A binary version of this agent (Novichok-7) was developed with components $C_2H_5PO(F)(CN)$ and N,N-Diethylethanimidamide (C01-C107).

Exposure Hazards

Conversion Factor: 1 ppm = 9.17 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 224.2	*VP:* —	*FlP:* —
D: 1.4 g/mL	*VD:* 7.7	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 163°F	*ER:* —	*RP:* —
Vsc: —	*H_2O:* —	*IP:* 8.36 eV (est.)
	Sol: —	

C01-A039

1,1,3,3-Tetraethyl-2-[fluoro(methyl)phosphoryl]guanidine (A-242)

CAS: —

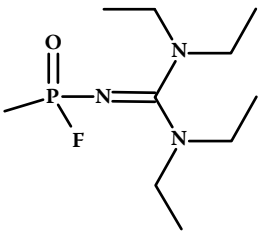
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



$C_{10}\ H_{23}\ F\ N_3\ O\ P$

Solid. Other specific information is not available for this material. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Conversion Factor: 1 ppm = 10.28 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 251.3	*VP:* —	*FlP:* —
D: —	*VD:* 8.7	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: —	*ER:* —	*RP:* —
Vsc: —	*H_2O:* —	*IP:* —
	Sol: —	

C01-A040

1,1,3,3-Tetraethyl-2-[fluoro(methoxy)phosphoryl]guanidine (A-262)

CAS: —

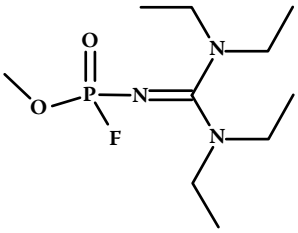
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



C_{10} H_{23} F N_3 O_2 P

Solid. Other specific information is not available for this material. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Conversion Factor: 1 ppm = 10.93 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

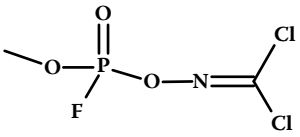
MW: 267.3	*VP:* —	*FlP:* —
D: —	*VD:* 9.2	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: —	*ER:* —	*RP:* —
Vsc: —	*H_2O:* —	*IP:* —
	Sol: —	

OXIME SERIES AGENTS

C01-A041

[(Fluoromethoxyphosphinyl)oxy]carbonimidic Dichloride

CAS: 17642-31-8
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_2 H_3 Cl_2 F N O_3 P$

Specific information is not available for this agent.

Exposure Hazards

Conversion Factor: 1 ppm = 8.59 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

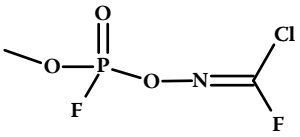
Properties:

MW: 209.9	*VP:* —	*FlP:* —
D: 1.5 g/mL	*VD:* 7.2	*LEL:* —
MP: —	*Vlt:* 600 ppm (est.)	*UEL*: —
BP: 135°F (2 mmHg)	*ER:* —	*RP:* —
Vsc: —	*H_2O:* —	*IP:* —
	Sol: —	

C01-A042

[(Fluoromethoxyphosphinyl)oxy]carbonimidic Chloride Fluoride

CAS: 17642-26-1
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_2 H_3 Cl F_2 N O_3 P$

Specific information is not available for this agent.

Exposure Hazards

Conversion Factor: 1 ppm = 7.91 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 193.5	*VP:* —	*FlP:* —
D: 1.5 g/mL	*VD:* 6.7	*LEL:* —
MP: —	*Vlt:* 2,000 ppm (est.)	*UEL*: —
BP: 158°F (2 mmHg)	*ER:* —	*RP:* —
Vsc: —	*H_2O:* —	*IP:* —
	Sol: —	

C01-A043

[(Fluoromethoxyphosphinyl)oxy]carbonimidic Difluoride

CAS: 18016-10-9

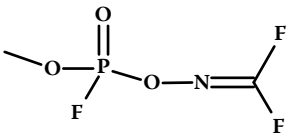
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



C_2 H_3 F_3 N O_3 P

Specific information is not available for this agent.

Exposure Hazards

Conversion Factor: 1 ppm = 7.24 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 177.0	*VP:* —	*FlP:* —
D: 1.4 g/mL	*VD:* 6.1	*LEL:* —
MP: —	*Vlt:* 10,000 ppm (est.)	*UEL*: —
BP: 136°F (20 mmHg)	*ER:* —	*RP:* —
Vsc: —	*H_2O:* —	*IP:* —
	Sol: —	

C01-A044

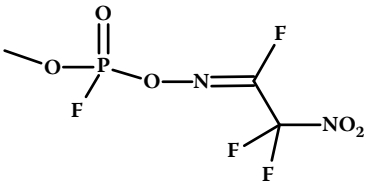
2,2-Difluoro-N-[(fluoromethoxyphosphinyl)oxy]-2-nitroethanimidoyl Fluoride

CAS: 17642-29-4

RTECS: —

UN: —

EC: —
UNII: —
ICD-11: —



$C_3\ H_3\ F_4\ N_2\ O_5\ P$

Specific information is not available for this agent.

Exposure Hazards

Conversion Factor: 1 ppm = 10.39 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

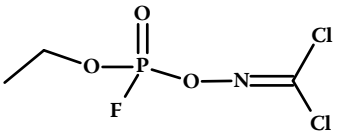
Properties:

MW: 254.0	*VP:* —	*FlP:* —
D: 1.6 g/mL	*VD:* 8.8	*LEL:* —
MP: —	*Vlt:* 900 ppm (est.)	*UEL*: —
BP: 169°F (3 mmHg)	*ER:* —	*RP:* —
Vsc: —	*H_2O:* —	*IP:* —
	Sol: —	

C01-A045

[(Ethoxyfluorophosphinyl)oxy]carbonimidic Dichloride

CAS: 17642-32-9
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_3\ H_5\ Cl_2\ F\ N\ O_3\ P$

Specific information is not available for this agent.

Exposure Hazards

Conversion Factor: 1 ppm = 9.16 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 224.0	*VP:* —	*FlP:* —
D: 1.4 g/mL	*VD:* 7.7	*LEL:* —
MP: —	*Vlt:* 200 ppm (est.)	*UEL*: —
BP: 189°F (4 mmHg)	*ER:* —	*RP:* —
Vsc: —	*H_2O:* —	*IP:* —
	Sol: —	

C01-A046

[(Ethoxyfluorophosphinyl)oxy]carbonimidic Chloride Fluoride

CAS: 17642-27-2

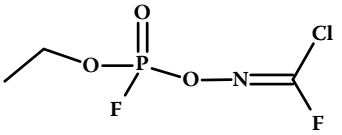
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



C_3 H_5 Cl F_2 N O_3 P

Specific information is not available for this agent.

Exposure Hazards

Conversion Factor: 1 ppm = 8.49 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 207.5	*VP:* —	*FlP:* —
D: 1.5 g/mL	*VD:* 7.2	*LEL:* —
MP: —	*Vlt:* 1,000 ppm (est.)	*UEL*: —
BP: 167°F (4 mmHg)	*ER:* —	*RP:* —
Vsc: —	*H_2O:* —	*IP:* —
	Sol: —	

C01-A047

[(Ethoxyfluorophosphinyl)oxy]carbonimidic Difluoride

CAS: 17642-28-3

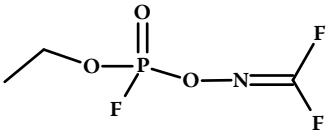
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



$C_3\ H_5\ F_3\ N\ O_3\ P$

Specific information is not available for this agent.

Exposure Hazards

Conversion Factor: 1 ppm = 7.81 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 191.0	*VP:* —	*FlP:* —
D: —	*VD:* 6.6	*LEL:* —
MP: —	*Vlt:* 4,000 ppm (est.)	*UEL*: —
BP: 129°F (5 mmHg)	*ER:* —	*RP:* —
Vsc: —	*H_2O:* —	*IP:* —
	Sol: —	

C01-A048

N-[(Ethoxyfluorophosphinyl)oxy]-2,2-difluoro-2-nitroethanimidoyl Fluoride

CAS: 17642-30-7

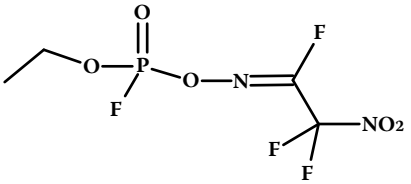
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



$C_4\ H_5\ F_4\ N_2\ O_5\ P$

Specific information is not available for this agent.

Exposure Hazards

Conversion Factor: 1 ppm = 10.96 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

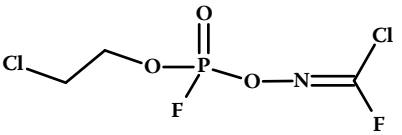
MW: 268.1	*VP:* —	*FlP:* —
D: 1.5 g/mL	*VD:* 9.2	*LEL:* —
MP: —	*Vlt:* 200 ppm (est.)	*UEL*: —

BP: 178°F (5 mmHg)	*ER:* —	*RP:* —
Vsc: —	*H_2O:* —	*IP:* —
	Sol: —	

C01-A049

[[(2-Chloroethoxy)fluorohydroxyphosphinyl]oxy]carbonimidic Chloride Fluoride

CAS: 26102-97-6
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



C_3 H_4 Cl_2 F_2 N O_3 P

Specific information is not available for this agent.

Exposure Hazards

Conversion Factor: 1 ppm = 9.90 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

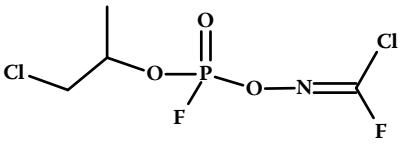
Properties:

MW: 241.9	*VP:* —	*FlP:* —
D: —	*VD:* 8.3	*LEL:* —
MP: —	*Vlt:* 60 ppm (est.)	*UEL*: —
BP: —	*ER:* —	*RP:* —
Vsc: —	*H_2O:* —	*IP:* —
	Sol: —	

C01-A050

[[(2-Chloro-1-methylethoxy)fluorophosphinyl]oxy]carbonimidic Chloride Fluoride

CAS: 26102-98-7
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_4\ H_6\ Cl_2\ F_2\ N\ O_3\ P$

Specific information is not available for this agent.

Exposure Hazards

Conversion Factor: 1 ppm = 10.47 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 256.0	*VP:* —	*FlP:* —
D: —	*VD:* 8.8	*LEL:* —
MP: —	*Vlt:* 40 ppm (est.)	*UEL*: —
BP: —	*ER:* —	*RP:* —
Vsc: —	*H_2O:* —	*IP:* —
	Sol: —	

C01-A051

[[(2-Chloro-1-methylpropoxy)fluorophosphinyl]oxy]carbonimidic Chloride Fluoride

CAS: 26102-99-8

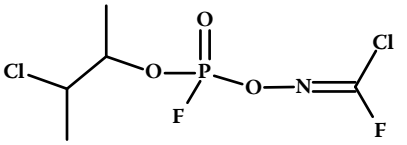
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



$C_5\ H_8\ Cl_2\ F_2\ N\ O_3\ P$

Specific information is not available for this agent.

Exposure Hazards

Conversion Factor: 1 ppm = 11.04 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

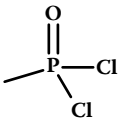
Properties:

MW: 270.0	*VP:* —	*FlP:* —
D: —	*VD:* 9.3	*LEL:* —
MP: —	*Vlt:* 20 ppm (est.)	*UEL*: —
BP: —	*ER:* —	*RP:* —
Vsc: —	*H_2O:* —	*IP:* —
	Sol: —	

C01-C COMPONENTS AND PRECURSORS

C01-C052

Methylphosphonic Dichloride (DC)
CAS: 676-97-1
RTECS: —
UN: 9206; 137
EC: 211-634-4
UNII: —
ICD-11: —



C H_3 Cl_2 O P

Clear solid or liquid with a pungent, stinging, disagreeable odor. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts.

May cause severe and painful irritation of the eyes, nose, throat and lungs. Severe exposure can cause accumulation of fluid in the lungs (pulmonary edema). Inhalation toxicity similar to hydrogen chloride and hydrogen fluoride. May cause second- or third-degree burns upon short contact with skin surfaces. Oral ingestion may result in tissue destruction of the gastrointestinal tract. Decreased blood cholinesterase levels have been reported in animals.
This material is on Schedule 2 of the CWC and the Australia Group Export Control list.

This material is a general precursor for nerve agents. It may appear as a mixture with methylphosphonic difluoride (C01-C053), designated as Didi, that is used as a constituent for binary G-series nerve agents.

Exposure Hazards
Conversion Factor: 1 ppm = 5.44 mg/m^3 at 77°F

Edgewood Research Development, and Engineering Center Permissible Exposure Limit (1995): 0.006 ppm

$MEG_{(1hr)}$: Neg: 0.037 ppm; Mar: 0.26 ppm; Crit: 2.8 ppm; Cat: —
PAC-1: 0.024 ppm; *PAC-2:* 0.26 ppm; *PAC-3:* 1.1 ppm

Properties:

MW: 132.9	*VP:* 10 mmHg (122°F)	*FlP:* 300°F
D: 1.6 g/mL (79°F)	*VD:* 4.6	*LEL:* —
MP: 88°F	*Vlt:* 12,000 ppm (122°F)	*UEL*: —
BP: 331°F	*ER:* —	*RP:* 0.95 (122°F)
Vsc: —	*H_2O:* Reacts	*IP:* —
	Sol: —	

C01-C053

Methylphosphonic Difluoride (DF)

CAS: 676-99-3

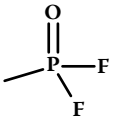
RTECS: T01840700

UN: —

EC: —

UNII: Z7V517240K

ICD-11: —



C H_3 F_2 OP

Liquid with a pungent, acid-like odor. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts.

May cause severe and painful irritation of the eyes, nose, throat and lungs. Severe exposure can cause accumulation of fluid in the lungs (pulmonary edema). Inhalation toxicity similar to hydrogen chloride and hydrogen fluoride. May cause second- or third-degree burns upon short contact with skin surfaces. Oral ingestion may result in tissue destruction of the gastrointestinal tract. High overexposure may inhibit cholinesterase.

This material is on Schedule 1 of the CWC and the Australia Group Export Control list.

This material is a constituent in GB2, which is the binary version of sarin (C01-A002). It is also commonly found as a decomposition product/impurity in unitary sarin. It may appear as a mixture with methylphosphonic dichloride (C01-C052), known as Didi, that is also used as a constituent for binary G-series nerve agents.

Exposure Hazards

Conversion Factor: 1 ppm = 4.09 mg/m^3 at 77°F

Edgewood Research Development, and Engineering Center Permissible Exposure Limit (1995): 0.002 ppm.

$MEG_{(1hr)}$: Neg: 0.61 ppm; Mar: 4.9 ppm; Crit: 24 ppm; Cat: —
PAC-1: 0.092 ppm; *PAC-2:* 1.0 ppm; *PAC-3:* 6.1 ppm

Properties:

MW: 100.1	*VP:* 36 mmHg (77°F)	*FlP:* NA
D: 1.4 g/mL (77°F)	*VD:* 3.5	*LEL:* NA
MP: –35°F	*Vlt:* 36,000 ppm	*UEL*: NA
BP: 212°F	*ER:* —	*RP:* 0.28
Vsc: —	*H_2O:* Reacts	*IP:* —
	Sol: —	

C01-C054

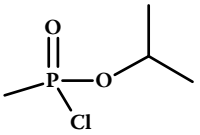
Chlorosarin

CAS: 1445-76-7

RTECS: —

UN: —

EC: —
UNII: 0DNX22ZOWK
ICD-11: —



$C_4\ H_{10}\ Cl\ O_2\ P$

Colorless and odorless liquid when pure.

This material is on Schedule 1 of the CWC and the DHS Chemicals of Interest list.

This material is a precursor for sarin (C01-A002).

Exposure Hazards

Conversion Factor: 1 ppm = 6.40 mg/m^3 at 77°F

This material is expected to be only slightly less toxic than Sarin (C01-A002)

$MEG_{(1hr)}$: Neg: 0.00047 ppm; Mar: 0.0063 ppm; Crit: 0.020 ppm; Cat: —
PAC-1: 0.00048 ppm; *PAC-2:* 0.0059 ppm; *PAC-3:* 0.022 ppm

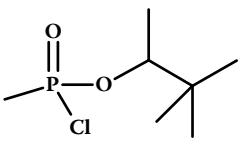
Properties:

MW: 156.6	*VP:* 1.54 mmHg (est.)	*FlP:* —
D: —	*VD:* 5.4	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: —	*ER:* —	*RP:* —
Vsc: —	*H_2O:* Reacts	*IP:* —
	Sol: —	

C01-C055

Chlorosoman

CAS: 7040-57-5
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_7\ H_{16}\ Cl\ O_2\ P$

Colorless and odorless liquid when pure.

This material is on Schedule 1 of the CWC and the DHS Chemicals of Interest list.

This material is a precursor for soman (C01-A003).

Exposure Hazards

Conversion Factor: 1 ppm = 8.12 mg/m^3 at 77°F

This material is expected to be only slightly less toxic than soman (C01-A003)

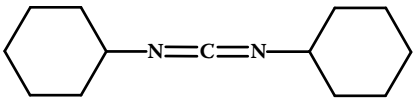
MEG$_{(1hr)}$: Neg: 0.09 ppm; Mar: 0.62 ppm; Crit: 3.1 ppm; Cat: —
PAC-1: 0.00018 ppm; *PAC-2:* 0.0022 ppm; *PAC-3:* 0.017 ppm

Properties:

MW: 198.6	*VP:* 0.21 mmHg (77°F) (est.)	*FlP:* —
D: —	*VD:* 6.9	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 122°F (1.5 mmHg)	*ER:* —	*RP:* —
Vsc: —	*H_2O:* Reacts	*IP:* —
	Sol: —	

C01-C056

Dicyclohexylcarbodiimide (DCCDI)
CAS: 538-75-0
RTECS: FF2160000
UN: —
EC: 208-704-1
UNII: 0T1427205E
ICD-11: —



C_{13} H_{22} N_2

Colorless to white crystalline solid with a heavy sweet odor. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

Causes severe eye irritation, skin irritation, nausea, headache, and vomiting. Inhalation is irritating to the mucous membranes and upper respiratory tract. May cause sensitization by skin contact.

This material is a stabilizer for G-series and V-series nerve agents, usually within the range of 2% to 10% by weight.

Exposure Hazards

Conversion Factor: 1 ppm = 8.44 mg/m^3 at 77°F
MEG$_{(1hr)}$: Neg: 0.010 mg/m^3; Mar: 0.060 mg/m^3; Crit: 100 mg/m^3; Cat: —
PAC-1: 0.12 mg/m^3; *PAC-2:* 1.3 mg/m^3; *PAC-3:* 8.0 mg/m^3

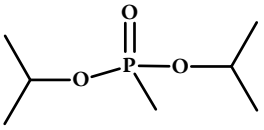
Properties:

MW: 206.3	*VP:* 0.5 mmHg (212°F)	*FlP:* 235°F
D: —	*VD:* 7.1	*LEL:* —
MP: 93°F	*Vlt:* —	*UEL*: —

BP: 316°F (12 mmHg)	*ER:* —	*RP:* —
Vsc: —	*H_2O:* Reacts	*IP:* —
	Sol: Methylene chloride	

C01-C057

Diisopropyl Methylphosphonate (DIMP)
CAS: 1445-75-6
RTECS: SZ9090000
UN: —
EC: 215-896-0
UNII: 56V3OG5DC7
ICD-11: —



$C_7\ H_{17}\ O_3\ P$

Colorless liquid. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion.

This material is on Schedule 2 of the CWC.

This material is a precursor for sarin (C01-A002) and is also commonly found as a decomposition product/impurity (up to 20%) in sarin. If fluoride ion is present and the pH falls below 7, sarin will be formed. This material has been used as a simulant for nerve agents in government tests.

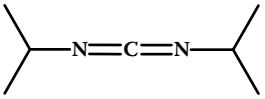
Exposure Hazards
Conversion Factor: 1 ppm = 7.37 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.81 ppm; Mar: 5.4 ppm; Crit: 47 ppm; Cat: —
PAC-1: 0.37 ppm; *PAC-2:* 4.1 ppm; *PAC-3:* 24 ppm

Properties:

MW: 180.2	*VP:* 0.17 mmHg (77°F)	*FlP:* 208°F
D: 0.99 g/mL (77°F)	*VD:* 6.2	*LEL:* —
MP: —	*Vlt:* 220 ppm (77°F)	*UEL*: —
BP: 345°F	*ER:* —	*RP:* 44
Vsc: —	*H_2O:* 8% (32°F)	*IP:* —
	Sol: —	

C01-C058

Diisopropylcarbodiimide (DIPC)
CAS: 693-13-0
RTECS: FF2175000
UN: —
EC: 211-743-7
UNII: OQO20I6TWH
ICD-11: —



$C_7\ H_{14}\ N_2$

Clear, colorless to yellow to faint brown liquid with a foul odor. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

Causes severe eye irritation that can progress to severe corneal edema. Temporary blindness has been reported. Causes skin irritation, nausea, headache, and vomiting. Inhalation is irritating to the mucous membranes and upper respiratory tract. May cause sensitization by skin contact.

Used industrially as an activating reagent in solid phase synthesis.

This material is on the FBI threat list.

This material is a stabilizer for G-series and V-series nerve agents, usually within the range of 2% to 10% by weight.

Exposure Hazards

Conversion Factor: 1 ppm = 5.16 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 126.2	*VP:* 5.1 mmHg (77°F)	*FlP:* 91°F
D: 0.82 g/mL	*VD:* 4.4	*LEL:* —
MP: —	*Vlt:* 6,700 ppm	*UEL*: —
BP: 296°F	*H_2O:* Reacts	*RP:* 1.8
Vsc: —	*Sol:* Chloroform, acetonitrile, dimethylformamide	*IP:* eV

C01-C059

Dimethyl Methylphosphonate (DMMP)

CAS: 756-79-6

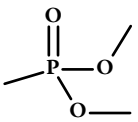
RTECS: SZ9120000

UN: —

EC: 212-052-3

UNII: 20Z996230U

ICD-11: —



$C_3\ H_9\ O_3\ P\ S$

Clear colorless liquid with a pleasant odor. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion.

Used industrially as a fire retardant, gasoline additive, antifoam agent, plasticizer, plastic stabilizer, textile conditioner, antistatic agent, and hydraulic fluid additive.

This material is on Schedule 2 of the CWC, the Australia Group Export Control list and DHS Chemicals of Interest list.

This material is a precursor for G-series nerve agents and is used as a simulant for nerve agents in government tests.

Exposure Hazards

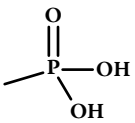
Conversion Factor: 1 ppm = 5.08 mg/m^3 at 77°F
MEG$_{(1hr)}$: Neg: 69 ppm; Mar: —; Crit: 98 ppm; Cat: —
PAC-1: 2.0 ppm; *PAC-2:* 22 ppm; *PAC-3:* 310 ppm

Properties:

MW: 124.1	*VP:* 0.61 mmHg (77°F)	*FlP:* 156°F
D: 1.2 g/mL	*VD:* 4.3	*LEL:* —
MP: –58°F	*Vlt:* 800 ppm (77°F)	*UEL*: —
BP: 360°F	*ER:* —	*RP:* —
Vsc: —	*H_2O:* Soluble	*IP:* 10.00 eV
	Sol: Alcohol, ether	

C01-C060

Methanephosphonic Acid (MPA)
CAS: 993-13-5
RTECS: —
UN: —
EC: 213-607-2
UNII: 29W4YM10Z
ICD-11: —



C H_5 O_3 P

White solid. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts.

Used industrially for organic synthesis and in the manufacture of lubricant additives and for treating textiles.

This material is on Schedule 2 of the CWC and the Australia Group Export Control list.

This material is a general precursor for nerve agents and is also commonly found as a decomposition product/impurity resulting from hydrolysis of G-series nerve agents. This material has been used as a simulant for nerve agents in government tests.

Exposure Hazards

Conversion Factor: 1 ppm = 3.93 mg/m^3 at 77°F
MEG$_{(1hr)}$: Neg: —; Mar: —; Crit: 10 mg/m^3; Cat: —
PAC-1: 30 mg/m^3; *PAC-2:* 330 mg/m^3; *PAC-3:* 2,000 mg/m^3

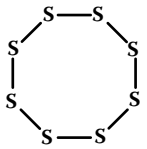
Properties:

MW: 96.0	*VP:* 2 × 10^{-6} mmHg	*FlP:* —
D: —	*VD:* 3.3	*LEL:* —

MP: 221°F	*Vlt:* —	*UEL*: —
BP: Decomposes	*ER:* —	*RP:* —
Vsc: —	H_2O: >100%	*IP:* —
	Sol: Ethanol, ether	

C01-C061

Sulfur (NE)
CAS: 7704-34-9
RTECS: WS4250000
UN: 1350; 133
EC: 231-722-6
UNII: 70FD1KFU70
ICD-11: XM3GD9



S_8

Fine, pale yellow, amorphous, or microcrystalline powder. May come as sublimed, washed, or precipitated. Pure sulfur exists in two stable crystalline forms and at least two amorphous (liquid) forms. The rhombic form is the principal material used in binary V-series agents. Pure sulfur is odorless but traces of hydrocarbon impurities may impart an oily and/or rotten egg odor to commercial material. This material is hazardous through inhalation and produces local skin/eye impacts.

Used industrially in manufacturing drugs and pharmaceuticals, medicated cosmetics and shampoos, sulfuric acid, carbon disulfide, sulfur dioxide, phosphorus pentasulfide, sulfites, insecticides, plastics, enamels, metal-glass cements, dyes, detergents, gunpowder, pyrotechnics, explosives, matches, phosphatic fertilizers. Used in petroleum refining, vulcanizing rubber, photographic film, cement sealant, binder and asphalt extender in road paving, for bleaching dried fruits, wood pulp, straw, wool, silk, felt, and linen. Used as a medication, fungicide, acaricide, and as an electrical insulator.

This material is a constituent in VX2, which is the binary version of VX (C01-A017).

Exposure Hazards

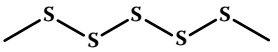
Conversion Factor: 1 ppm = 10.49 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.40 mg/m^3; Mar: 2.5 mg/m^3; Crit: 13 mg/m^3; Cat: —

Rhombic Sulfur Properties:

MW: 256.5	*VP:* 4×10^{-6} mmHg (87°F)	*FlP:* 405°F
D: 2.1 g/cm^3	*VD:* —	*LEL:* 35 g/m^3
MP: 235°F	*Vlt:* NA	*UEL*: 1,400 g/m^3
BP: 832°F	ER: —	*RP:* NA
Vsc: —	H_2O: Insoluble	*IP:* —
	Sol: Carbon disulfide, aromatic hydrocarbons	

C01-C062

Dimethylpolysulfide (NM)
CAS: 73062-48-3
RTECS: —
UN: —
EC: 277-263-5
UNII: —
ICD-11: —



C_2 H_6 S_5

Liquid with a very noxious odor. This material poses a considerable risk from inhalation of high concentrations.

This material is a constituent in VX2, which is the binary version of VX (C01-A017).

Exposure Hazards
Conversion Factor: 1 ppm = 7.79 mg/m^3 at 77°F (based on average molecular weight)

Human toxicity values have not been established or have not been published.

Properties:

MW: 190.4 (average)	*VP:* —	*FlP:* 221°F
D: 1.4 g/mL (77°F)	*VD:* 6.6	*LEL:* —
MP: –40°F	*Vlt:* —	*UEL*: —
BP: 243°F	*H_2O:* Insoluble	*RP:* Very persistent
Vsc: —	*Sol:* —	*IP:* —

C01-C063

Isopropyl Alcohol and Isopropyl Amine Mixture (OPA)
CAS: —
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —

Mixture
Clear liquid with an odor that is a mixture of alcohol and ammonia. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts.

Inhalation of the agent may cause irritation of the lower respiratory tract, coughing, difficulty breathing and, in high concentration, loss of consciousness. It causes severe irritation in contact with the skin and eyes. If ingested, it causes nausea, salivation, and severe irritation of the mouth and stomach.

A similar mixture is used industrially in processing cutting oils.

This material is a constituent in GB2, which is the binary version of sarin (C01-A002).

Exposure Hazards

Conversion Factor: NA

Human toxicity values have not been established or have not been published.

Properties:

MW: Mixture	*VP:* 197 mmHg (77°F)	*FlP:* 15°F
D: 0.74 g/mL (77°F)	*VD:* 2.1	*LEL:* —
MP: <–126°F	*Vlt:* —	*UEL*: —
BP: 140°F	H_2O: Soluble	*RP:* —
Vsc: —	*Sol:* —	*IP:* —

C01-C064

O-Ethyl 2-Diisopropylaminoethyl Methylphosphonite (QL)

CAS: 57856-11-8; 101078-31-3 (Hydroiodide salt)

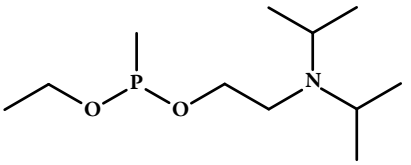
RTECS: —

UN: —

EC: —

UNII: 8154M6X68L

ICD-11: —



C_{11} H_{26} N O_2 P

Viscous liquid with a strong fishy odor. Various salts (solids) have been reported. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts. Hydrolysis when there is only a limited amount of water produces O,O′-Diethyl methylphosphonite (TR), which is highly reactive and toxic.

This material is on Schedule 1 of the CWC, the Australia Group Export Control list and DHS Chemicals of Interest list.

This material is a constituent in VX2, which is the binary version of VX (C01-A017).

Exposure Hazards

Conversion Factor: 1 ppm = 9.62 mg/m^3 at 77°F

$MEG_{(1hr)}$: Neg: 3.1 ppm; Mar: 5.2 ppm; Crit: 26 ppm; Cat: —

PAC-1: 3.1 ppm; *PAC-2:* 34 ppm; *PAC-3:* 210 ppm

Properties:

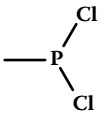
MW: 235.3	*VP:* 0.01 mmHg (77°F)	*FlP:* 192°F
D: 0.91 g/mL (77°F)	*VD:* 8.1	*LEL:* —
MP: —	*Vlt:* 13 ppm (77°F)	*UEL*: —
BP: 450°F	*ER:* —	*RP:* 660
Vsc: 2.2 cs (77°F)	H_2O: Reacts	*IP:* —
	Sol: —	

O,O′-Diethyl Methylphosphonite (TR) {Hydrolysis by-product}
CAS: 15715-41-0
MW: 136.1

D: 0.90 g/mL	*VP:* 11 mmHg	*FlP:* 82°F
MP: —	*VD:* —	Autoignition temperature: 104°F
BP: 248°F	*Vlt:* —	

C01-C065

Methylphosphinyl Dichloride (SW)
CAS: 676-83-5
RTECS: —
UN: —
EC: 211-631-8
UNII: —
ICD-11: —



C H_3 Cl_2 P

Clear colorless liquid with a pungent odor. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Spontaneously flammable in air at or slightly above normal temperature.

Used industrially for organic synthesis.

This material is on Schedule 2 of the CWC and the Australia Group Export Control List.

This material is used to synthesize precursors for all series of nerve agents.

Exposure Hazards
Conversion Factor: 1 ppm = 4.78 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.31 ppm; Mar: 2.1 ppm; Crit: 10 ppm; Cat: —
PAC-1: 0.25 ppm; *PAC-2:* 2.7 ppm; *PAC-3:* 17 ppm

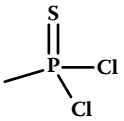
Properties:

MW: 116.9	*VP:* —	*FlP:* 118°F
D: 1.3 g/mL	*VD:* 4.0	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 176°F	*ER:* —	*RP:* —
Vsc: —	*H_2O:* Reacts	*IP:* 9.85 eV
	Sol: —	

C01-C066

Methylphosphonothioic Dichloride (SWS)
CAS: 676-98-2

RTECS: TB2100000
UN: —
EC: 211-636-5
UNII: —
ICD-11: —



C H_3 Cl_2 P S

Colorless liquid with a pungent odor. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts.

This material is on Schedule 2 of the CWC, the Australia Group Export Control List, and the DHS Chemicals of Interest list.

This material is used to synthesize precursors to V-series nerve agents.

Exposure Hazards

Conversion Factor: 1 ppm = 6.09 mg/m^3 at 77°F

Inhalation cause irritation of the nose and throat.

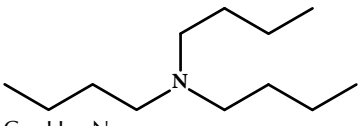
$MEG_{(1hr)}$: Neg: 0.66 ppm; Mar: 4.9 ppm; Crit: 250 ppm; Cat: —
PAC-1: 0.20 ppm; *PAC-2:* 2.1 ppm; *PAC-3:* 13 ppm

Properties:

MW: 149.0	*VP:* —	*FlP:* 163°F
D: 1.4 g/mL	*VD:* 5.1	*LEL:* —
MP: –14°F	*Vlt:* —	*UEL*: —
BP: 111°F (9 mmHg)	*ER:* —	*RP:* —
Vsc: —	*H_2O:* Reacts	*IP:* 8.60 eV
	Sol: —	

C01-C067

Tributylamine (TBA)
CAS: 102-82-9; 6309-30-4 (Hydrochloride salt)
RTECS: YA0350000
UN: 2542; 153
EC: 203-058-7
UNII: C3TZB2W0R7
ICD-11: —



C_{12} H_{27} N

Pale yellow hygroscopic liquid with an ammonia odor. Various salts (solids) have been reported. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

Causes irritating to skin, eyes, and respiratory system, CNS stimulation, skin irritation, sensitization. Causes severe eye and skin burns. May cause severe tearing, conjunctivitis, and corneal edema. Inhalation may cause difficulties ranging from coughing and nausea to accumulation of fluid in the lungs (pulmonary edema).

Used industrially as a solvent, inhibitor in hydraulic fluids, polymerization catalyst, insecticide, emulsifying agent, and as a chemical intermediate.

This material is a stabilizer for nerve agents.

Exposure Hazards

Conversion Factor: 1 ppm = 7.58 mg/m^3 at 77°F
MEG$_{(1hr)}$: Neg: 0.067 ppm; Mar: 0.46 ppm; Crit: 7.9 ppm; Cat: —
PAC-1: 0.049 ppm; *PAC-2:* 0.54 ppm; *PAC-3:* 3.2 ppm

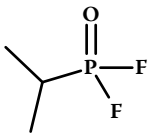
Properties:

MW: 185.4	*VP:* 0.0934 mmHg (77°F)	*FlP:* 187°F
D: 0.78 g/mL	*VD:* 6.4	*LEL:* —
MP: –94°F	*Vlt:* 120 ppm (77°F)	*UEL*: —
BP: 422°F	*ER:* —	*RP:* 79
Vsc: 1.7 cs (77°F)	*H_2O:* 0.014% (77°F)	*IP:* 7.40 eV
	Sol: Most organic solvents	

C01-C068

Isopropylphosphonic Difluoride

CAS: 677-42-9
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



C_3 H_7 F_2 O P

Specific information is not available for this agent. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts.

May cause severe and painful irritation of the eyes, nose, throat and lungs. Severe exposure can cause accumulation of fluid in the lungs (pulmonary edema). Inhalation toxicity similar to hydrogen chloride and hydrogen fluoride. May cause second- or third-degree burns upon short contact with skin surfaces. Oral ingestion may result in tissue destruction of the gastrointestinal tract. High overexposure may inhibit cholinesterase.

This material is on Schedule 1 of the CWC and the DHS Chemicals of Interest list.

This material is a binary constituent in G-series nerve agents.

Exposure Hazards

Conversion Factor: 1 ppm = 5.24 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 128.1	*VP:* —	*FlP:* —
D: 1.2 g/mL	*VD:* 4.4	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 234°F	*H_2O:* Reacts	*RP:* —
Vsc: —	*Sol:* —	*IP:* —

C01-C069

Ethyl Methylphosphonothioic Acid

CAS: 18005-40-8; 22307-81-9 (Sodium salt); 73790-51-9 (Dicyclohexylamine salt)

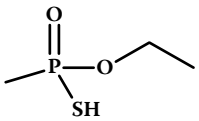
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



C_3 H_9 O_2 P S

Light yellow liquid. Various salts (solids) have been reported.

Used industrially for organic synthesis and the manufacturing of pesticides.

This material is on Schedule 2 of the CWC.

This material is a binary constituent in V-series nerve agents. It is also commonly found as a decomposition product/impurity from hydrolysis of V-series agents.

Exposure Hazards

Conversion Factor: 1 ppm = 5.73 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 140.1	*VP:* 0.043 mmHg	*FlP:* 225°F
D: 1.2 g/mL (77°F)	*VD:* 4.8	*LEL:* —
MP: —	*Vlt:* 58 ppm	*UEL*: —
BP: 163°F (0.75 mmHg)	*H_2O:* 0.11%	*RP:* 200
Vsc: —	*Sol:* —	*IP:* —

C01-C070

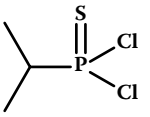
Isopropylphosphonothioic Dichloride

CAS: 1498-60-8

RTECS: —

UN: —

EC: —
UNII: —
ICD-11: —



C_3 H_7 Cl_2 P S

Specific information is not available for this material.

This material is on the DHS Chemicals of Interest list.

Exposure Hazards

Conversion Factor: 1 ppm = 7.24 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

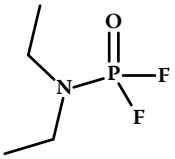
Properties:

MW: 177.0	*VP:* —	*FlP:* —
D: —	*VD:* 6.1	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: —	*ER:* —	*RP:* —
Vsc: —	*H_2O:* Reacts	*IP:* —
	Sol: —	

C01-C071

Diethylphosphoramidic Difluoride

CAS: 359-94-4
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



C_4 H_{10} F_2 N O P

Specific information is not available for this agent. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts.

May cause severe and painful irritation of the eyes, nose, throat and lungs. Severe exposure can cause accumulation of fluid in the lungs (pulmonary edema). Inhalation toxicity similar to hydrogen chloride and hydrogen fluoride. May cause second- or third-degree burns upon short contact with skin surfaces. Oral ingestion may result in tissue destruction of the gastrointestinal tract. High overexposure may inhibit cholinesterase.

This material is a binary constituent in G-series and GV-series nerve agents.

Exposure Hazards

Conversion Factor: 1 ppm = 6.43 mg/m^3 at 77°F

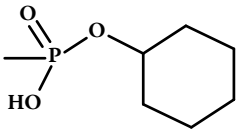
Human toxicity values have not been established or have not been published.

Properties:

MW: 157.1	*VP:* —	*FlP:* —
D: —	*VD:* 5.4	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 113°F (15mmHg)	H_2O: Reacts	*RP:* —
Vsc: —	*Sol:* —	*IP:* —

C01-C072

Cyclohexyl Methylphosphonic Acid (CMPA)
CAS: 1932-60-1; 108130-75-2 (Sodium salt)
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



C_7 H_{15} O_3 P

Specific information is not available for this material. Various salts (solids) have been reported. This material is on Schedule 2 of the CWC.

This material is a precursor for cyclosarin (C01-A005). It is also commonly found as a decomposition product/impurity and degradation product from hydrolysis of that agent and metabolite from exposure to the agent.

Exposure Hazards

Conversion Factor: 1 ppm = 7.29 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 30 mg/m^3; Mar: 50 mg/m^3; Crit: 250 mg/m^3; Cat: —
PAC-1: 30 mg/m^3; *PAC-2:* 330 mg/m^3; *PAC-3:* 2,000 mg/m^3

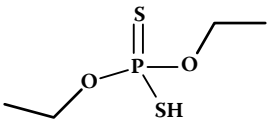
Properties:

MW: 178.2	*VP:* —	*FlP:* 248°F
D: 1.1 g/mL	*VD:* 6.1	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 525°F	*ER:* —	*RP:* —
Vsc: —	H_2O: —	*IP:* —
	Sol: —	

C01-C073

O,O-Diethyl Phosphorodithioate

CAS: 298-06-6; 3338-24-7 (Sodium salt); 3454-66-8 (Potassium salt)
RTECS: TD7350000
UN: —
EC: 206-055-9
UNII: 02C5XR639P
ICD-11: —



$C_4\ H_{11}\ O_2\ P\ S_2$

Colorless to nearly colorless liquid with an unpleasant odor like rotten eggs. Industrial material may appear black due to impurities. Various salts (solids) have been reported.

Used industrially in the manufacturing of pesticides. Salts are used as oil additives, in analytical chemistry, as a flotation agent for various ores, and in the manufacture of fertilizers.

This material is on the Australia Group Export Control List.

Exposure Hazards

Conversion Factor: 1 ppm = 7.62 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

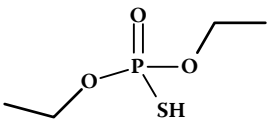
Properties:

MW: 186.2	*VP:* 0.0887 mmHg (77°F)	*FlP:* 181°F
D: 1.1 g/mL (77°F)	*VD:* 6.4	*LEL:* —
MP: –76°F	*Vlt:* 120 ppm	*UEL*: —
BP: 140°F (1 mmHg)	*ER:* 150	*RP:* 83
Vsc: —	*H_2O:* Soluble	*IP:* 8.30 eV
	Sol: —	

C01-C074

O,O-Diethyl Phosphorothioate

CAS: 2465-65-8; 5852-63-1 (Sodium salt); 5871-17-0 (Potassium salt)
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_4\ H_{11}\ O_3\ P\ S$

Solid. Various salts (solids) have been reported.

This material is on the Australia Group Export Control List.

This material is a potential precursor to V-series nerve agents. It is a hydrolysis product of diazinon (C11-A051) and the most frequently produced metabolite from exposure to organothiophosphorus insecticides found in urine.

Exposure Hazards

Conversion Factor: 1 ppm = 6.96 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 170.2	*VP:* 0.0379 mmHg (77°F)	*FlP:* 181°F
D: 1.2 g/mL	*VD:* 5.9	*LEL:* —
MP: —	*Vlt:* 50 ppm	*UEL*: —
BP: 415°F	*ER:* —	*RP:* 204
Vsc: —	*H_2O:* —	*IP:* —
	Sol: —	

C01-C075

Thiophosphoryl Chloride

CAS: 3982-91-0
RTECS: XN2930000
UN: 1837; 157
EC: 223-622-6
UNII: II99F8594N
ICD-11: —

Cl_3PS

Clear, colorless fuming liquid with a pungent, penetrating odor. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts.

Used industrially in the manufacture of insecticides and agricultural chemicals.
This material is the Australia Chemicals of Security Concern list.

Exposure Hazards

Conversion Factor: 1 ppm = 6.93 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 5.8 ppm; Mar: 3.6 ppm; Crit: 8.7 ppm; Cat: —
PAC-1: 0.013 ppm; *PAC-2:* 0.14 ppm; *PAC-3:* 0.88 ppm

Properties:

MW: 169.4	*VP:* 21.98 mmHg (77°F)	*FlP:* NA
D: 1.7 g/mL (77°F)	*VD:* 5.8	*LEL:* NA
MP: –31°F	*Vlt:* 29,000 ppm	*UEL*: NA
BP: 257°F (decomposes)	*ER:* —	*RP:* 0.35
Vsc: —	*H_2O:* Reacts	*IP:* 9.71 eV
	Sol: Benzene, carbon tetrachloride, chloroform	

C01-C076

Potassium Fluoride
CAS: 7789-23-3
RTECS: TT0700000
UN: 1812; 154
EC: 232-151-5
UNII: 9082WG1G3F
ICD-11: XM2SG3

KF
Colorless to white hygroscopic crystals that are odorless. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

Used industrially as a cleaning agent, disinfecting agent, insecticide; to etch glass, and as a welding flux.

This material is on the Australia Group Export Control list.

This material is a precursor for G-series and GV-series nerve agents.

Exposure Hazards
Conversion Factor: 1 ppm = 2.38 mg/m^3 at 77°F
MEG$_{(1hr)}$: Neg: 23 mg/m^3; Mar: 38 mg/m^3; Crit: 500 mg/m^3; Cat: —
PAC-1: 23 mg/m^3; *PAC-2:* 250 mg/m^3; *PAC-3:* 1,500 mg/m^3
PEL: 2.5 mg/m^3 as fluoride
REL: 2.5 mg/m^3 as fluoride
IDLH: 250 mg/m^3 as fluoride

Properties:

MW: 58.1	*VP:* —	*FlP:* NA
D: 2.5 g/cm^3	*VD:* —	*LEL:* NA
MP: 1,576°F	*Vlt:* NA	*UEL*: NA
BP: 2,741°F	*ER:* NA	*RP:* NA
Vsc: —	*H_2O:* 92% (64°F)	*IP:* —
	Sol: —	

C01-C077

Sodium Fluoride
CAS: 7681-49-4
RTECS: WB0350000
UN: 1690; 154
EC: 231-667-8
UNII: 8ZYQ1474W7
ICD-11: XM1F39

NaF
Colorless to white hygroscopic crystals that are odorless. Pesticide grade is often dyed blue. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

Used industrially as a fungicide, rodenticide, fluoridation agent in drinking water, a toothpaste ingredient, a glass frosting agent, an agent in ore flotation, a stainless steel pickling agent, a component of bitreous enamels, in removal of hydrogen fluoride from exhaust gases, in the manufacture of coated paper, for disinfecting fermentation apparatus in breweries and distilleries, in electroplating, as a component of glues and adhesives, a component of wood preservatives, as a sour in laundering cloth, and as a flux in the manufacture of rimmed steel, aluminum, and magnesium. Used medically as an anti-coagulant for blood.

This material is on the Australia Group Export Control list and NRL Critical Threat list.

This material is a precursor for G-series and GV-series nerve agents.

Exposure Hazards

Conversion Factor: 1 ppm = 1.72 mg/m^3 at 77°F
MEG$_{(1hr)}$: Neg: —; Mar: 5.5 mg/m^3; Crit: 500 mg/m^3; Cat: —
PAC-1: 17 mg/m^3; *PAC-2:* 90 mg/m^3; *PAC-3:* 1,100 mg/m^3
PEL: 2.5 mg/m^3 as fluoride
REL: 2.5 mg/m^3 as fluoride
IDLH: 250 mg/m^3 as fluoride

Properties:

MW: 42.0	*VP:* —	*FlP:* NA
D: 2.8 g/cm^3	*VD:* NA	*LEL:* NA
MP: 1,819°F	*Vlt:* NA	*UEL*: NA
BP: 3,099°F	*H_2O:* 4%	*RP:* —
Vsc: —	*Sol:* —	*IP:* —

C01-C078

Potassium Bifluoride

CAS: 7789-29-9
RTECS: TS6650000
UN: 1811; 154
EC: 232-156-2
UNII: 880X05W53M
ICD-11: —

KHF_2

White to light gray hygroscopic crystals that are odorless. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

Used industrially a welding flux, wood preservative, and in the ceramic industry.

This material is on the Australia Group Export Control list.

This material is a precursor for G-series and GV-series nerve agents.

Exposure Hazards

Conversion Factor: 1 ppm = 3.19 mg/m^3 at 77°F
MEG$_{(1hr)}$: Neg: 15 mg/m^3; Mar: 26 mg/m^3; Crit: 500 mg/m^3; Cat: —
PAC-1: 15 mg/m^3; *PAC-2:* 170 mg/m^3; *PAC-3:* 1,000 mg/m^3

PEL: 2.5 mg/m^3 as fluoride
REL: 2.5 mg/m^3 as fluoride
IDLH: 250 mg/m^3 as fluoride

Properties:

MW: 78.1	*VP:* —	*FlP:* —
D: 2.4 g/cm^3	*VD:* —	*LEL:* —
MP: 460°F	*Vlt:* NA	*UEL*: —
BP: —	*ER:* NA	*RP:* NA
Vsc: —	*H_2O:* 39%	*IP:* —
	Sol: —	

C01-C079

Sodium Bifluoride
CAS: 1333-83-1
RTECS: WB0350010
UN: 2439; 154
EC: 215-608-3
UNII: 3W2KK83V5G
ICD-11: —

$NaHF_2$
Colorless to white crystalline powder. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

Used industrially for etching glass, as an antiseptic and disinfectant, as a leather bleach, in the production of tin plate, for rust removal, as a welding flux, as a neutralizer in laundry rinsing operations, and as a cleaner for stone & brick building faces. Used to preserve zoological and anatomical specimens.

This material is on the Australia Group Export Control list.

This material is a precursor for G-series and GV-series nerve agents.

Exposure Hazards
Conversion Factor: 1 ppm = 2.54 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 10 mg/m^3; Mar: 75 mg/m^3; Crit: 410 mg/m^3; Cat: —
PAC-1: 12 mg/m^3; *PAC-2:* 140 mg/m^3; *PAC-3:* 820 mg/m^3
PEL: 2.5 mg/m^3 as fluoride
REL: 2.5 mg/m^3 as fluoride
IDLH: 250 mg/m^3 as fluoride

Properties:

MW: 62.0	*VP:* —	*FlP:* —
D: 2.1 g/cm^3	*VD:* —	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: —	*ER:* NA	*RP:* NA
Vsc: —	*H_2O:* Soluble	*IP:* —
	Sol: —	

C01-C080

Ammonium Bifluoride

CAS: 1341-49-7
RTECS: BQ9200000
UN: 1727; 154
EC: 215-676-4
UNII: C2M215358O
ICD-11: —

$(NH_4)HF_2$

White deliquescent crystalline solid that is odorless. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts.

Used industrially as a fungicide, in the manufacture magnesium fluoride, ceramics and in the production of fluorine, used industrially in electroplating and treating metals, in oil well acidizing, as a sour in laundering cloth, for brightening aluminum, etching glass, processing of beryllium, for cleaning and sterilizing beer, dairy, and other food equipment.

This material is on the Australia Group Export Control list.

This material is a precursor for G-series and GV-series nerve agents.

Exposure Hazards

Conversion Factor: 1 ppm = 2.33 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 10 mg/m^3; Mar: 75 mg/m^3; Crit: 380 mg/m^3; Cat: —
PAC-1: 11 mg/m^3; *PAC-2:* 130 mg/m^3; *PAC-3:* 750 mg/m^3
PEL: 2.5 mg/m^3 as fluoride
REL: 2.5 mg/m^3 as fluoride
IDLH: 250 mg/m^3 as fluoride

Properties:

MW: 57.0	*VP:* —	*FlP:* —
D: 1.5 g/cm^3	*VD:* —	*LEL:* —
MP: 258°F	*Vlt:* —	*UEL*: —
BP: 463°F	*H_2O:* 42% (77°F)	*RP:* —
Vsc: —	*Sol:* Slightly in ethanol	*IP:* —

C01-C081

Phosphorous Trichloride

CAS: 7719-12-2
RTECS: TH3675000
UN: 1809; 137
EC: 231-749-3
UNII: M97C0A6S8U
ICD-11: —

PCl_3

Colorless to yellow, fuming liquid with an irritating, pungent, acrid odor like hydrochloric acid. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts.

Used industrially for the manufacture of phosphorus oxychloride, phosphorus pentachloride, phosphites, organophosphorus pesticides, surfactants, gasoline additives, plasticizers, dyestuffs; used as a chlorinating agent and catalyst. Used to prepare rubber surfaces for electrodeposition of metal. Used as an ingredient of textile finishing agents.

This material is on Schedule 3 of the CWC, the Australia Group Export Control list, DHS Chemicals of Interest list, Australia Chemicals of Security Concern list, ITF-25 High Threat list, and NRL Critical Threat list.

This material is a general precursor for nerve agents and a chlorinating agent for sulfur and nitrogen vesicants.

Exposure Hazards

Conversion Factor: 1 ppm = 5.62 mg/m^3 at 77°F
$LD_{50\ (Ing)}$: 1 g (est.)
$MEG_{(1hr)}$: Neg: 0.34 ppm; Mar: 2.0 ppm; Crit: 5.7 ppm; Cat: —
PAC-1: 0.34 ppm; *PAC-2:* 2.0 ppm; *PAC-3:* 5.5 ppm
PEL: 0.5 ppm
REL: 0.2 ppm
TLV: 0.2 ppm
$STEL_{(ACGIH)}$: 0.5 ppm
$STEL_{(NIOSH)}$: 0.5 ppm
IDLH: 25 ppm

Final AEGLs
AEGL-1: 1 hr – 0.34 ppm; 4 hr – 0.34 ppm; 8 hr – 0.34 ppm
AEGL-2: 1 hr – 2.0 ppm; 4 hr – 1.3 ppm; 8 hr – 0.83 ppm
AEGL-3: 1 hr – 5.6 ppm; 4 hr – 3.5 ppm; 8 hr – 1.8 ppm

Properties:

MW: 137.4	*VP:* 100 mmHg (70°F)	*FlP:* NA
D: 1.6 g/mL (70°F)	*VD:* 4.7	*LEL:* NA
MP: –170°F	*Vlt:* 130,000 ppm (70°F)	*UEL*: NA
BP: 169°F	*ER:* 280	*RP:* 0.085
Vsc: —	H_2O: Reacts	*IP:* 9.91 eV
	Sol: Benzene, chloroform, ether	

C01-C082

Phosphorus Pentachloride

CAS: 10026-13-8
RTECS: TB6125000
UN: 1806; 137
EC: 233-060-3
UNII: 0EX753TYDU
ICD-11: —

PCl_5

White to pale yellow, crystalline solid with a pungent, unpleasant odor. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts.

Used industrially as a chlorinating agent, dehydrating agent, catalyst; in the manufacture of pharmaceuticals, and in aluminum metallurgy.

This material is on Schedule 3 of the CWC, the Australia Group Export Control list, DHS Chemicals of Interest list, and Australia Chemicals of Security Concern list.

This material is a general precursor for nerve agents and a chlorinating agent for sulfur and nitrogen vesicants.

Exposure Hazards

Conversion Factor: 1 ppm = 8.52 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.35 ppm; Mar: 2.3 ppm; Crit: 8.2 ppm; Cat: —
PAC-1: 0.31 ppm; *PAC-2:* 2.3 ppm; *PAC-3:* 23 ppm
PEL: 0.12 ppm
REL: 0.12 ppm
TLV: 0.10 ppm
IDLH: 8.2 ppm

Properties:

MW: 208.2	*VP:* 0.012 mmHg	*FlP:* NA
D: 3.6 g/cm^3	*VD:* 7.2	*LEL:* NA
MP: 324°F	*Vlt:* 16 ppm	*UEL*: NA
BP: Sublimes	*ER:* —	*RP:* 574
Vsc: —	*H_2O:* Reacts	*IP:* 10.20 eV
	Sol: Carbon disulfide, carbon tetrachloride	

C01-C083

Phosphorus Oxychloride

CAS: 10025-87-3
RTECS: TH4897000
UN: 1810; 137
EC: 233-060-3
UNII: 9XM78OL22K
ICD-11: —

$POCl_3$

Clear, colorless to yellow, oily fuming liquid with a pungent, musty odor that is disagreeable and lingering. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts. May ignite combustible materials.

Used industrially for the manufacture of organophosphorus compounds (Insecticides, dyes, pharmaceuticals, defoliants) as well as esters for plasticizers, gasoline additives, and hydraulic fluids; used in industry as a chlorinating agent, catalyst, dopant for semiconductor grade silicon, fire retarding agent, and solvent in cryoscopy.

This material is on Schedule 3 of the CWC, the Australia Group Export Control list, DHS Chemicals of Interest list, Australia Chemicals of Security Concern list, ITF-25 Medium Threat list, and NRL Critical Threat list.

This material is a general precursor for nerve agents and a chlorinating agent for sulfur and nitrogen vesicants.

Exposure Hazards

Conversion Factor: 1 ppm = 6.27 mg/m^3 at 77°F
MEG$_{(1hr)}$: Neg: —; Mar: 0.48 ppm; Crit: 0.85 ppm; Cat: —
PAC-1: 0.30 ppm; *PAC-2:* 0.48 ppm; *PAC-3:* 0.85 ppm
REL: 0.1 ppm
TLV: 0.1 ppm
STEL$_{(NIOSH)}$: 0.5 ppm

Final AEGLs
AEGL-1: Not Developed
AEGL-2: Not Developed
AEGL-3: 1 hr – 0.85 ppm; 4 hr – 0.54 ppm; 8 hr – 0.27 ppm

Properties:

MW: 153.3	*VP:* 40 mmHg (81°F)	*FlP:* NA
D: 1.6 g/mL (77°F)	*VD:* 5.3	*LEL:* NA
MP: 34°F	*Vlt:* 52,000 ppm	*UEL*: NA
BP: 222°F	*ER*: 260	*RP:* 0.21
Vsc: —	*H_2O:* Reacts	*IP:* 11.50 eV
	Sol: —	

C01-C084

Phosphorus Pentasulfide

CAS: 1314-80-3
RTECS: TH4375000
UN: 1340; 139
EC: 215-242-4
UNII: HJ1X20J1DX
ICD-11: —

P_4S_{10}

Greenish-gray to yellow, deliquescent crystalline solid, with an odor of rotten eggs due to the formation of hydrogen sulfide. Olfactory fatigue may occur at high concentrations. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts.

Phosphorus pentasulfide autoignites at 287°F. It may spontaneously ignite in the presence of moisture.

Used industrially for manufacture of pyrotechnics, safety matches, lubricating oil additive, pesticides, and in organic synthesis.

This material is on the Australia Group Export Control list and DHS Chemicals of Interest list.

This material is a general precursor for nerve agents.

Exposure Hazards

Conversion Factor: 1 ppm = 18.18 mg/m^3 at 77°F
MEG$_{(1hr)}$: Neg: 3.0 mg/m^3; Mar: 50 mg/m^3; Crit: 250 mg/m^3; Cat: —
PAC-1: 3.0 mg/m^3; *PAC-2:* 130 mg/m^3; *PAC-3:* 750 mg/m^3
PEL: 1 mg/m^3
REL: 1 mg/m^3
TLV: 1 mg/m^3

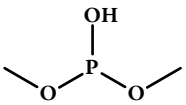
$STEL_{(ACGIH)}$: 3 mg/m^3
$STEL_{(NIOSH)}$: 3 mg/m^3
IDLH: 250 mg/m^3

Properties:

MW: 444.6	*VP:* 1 mmHg (572°F)	*FlP:* —
D: 2.1 g/cm^3	*VD:* 15	*MEC:* 500 g/m^3
MP: 550°F	*Vlt:* —	*UEC*: —
BP: 957°F	*ER:* —	*RP:* NA
Vsc: —	*H_2O:* Reacts	*IP:* —
	Sol: Carbon disulfide, aqueous bases	

C01-C085

Dimethyl Phosphite
CAS: 868-85-9
RTECS: SZ7710000
UN: —
EC: 212-783-8
UNII: ST4TBO000H
ICD-11: —



C_2 H_7 O_3 P

Mobile, colorless liquid with a mild odor. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Used industrially as a lubricant additive, flame retardant in textiles; to manufacture adhesives, and as a chemical intermediate

This material is on Schedule 3 of the CWC, the Australia Group Export Control list, DHS Chemicals of Interest list, and Australia Chemicals of Security Concern list.

This material is a general precursor for nerve agents. This material has been used as a simulant for nerve agents in government tests.

Exposure Hazards
Conversion Factor: 1 ppm = 4.50 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 13 ppm; Mar: 96 ppm; Crit: 150 ppm; Cat: —
PAC-1: 1.9 ppm; *PAC-2:* 21 ppm; *PAC-3:* 33 ppm

Interim AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 95 ppm; 4 hr – 60 ppm; 8 hr – 39 ppm
AEGL-3: 1 hr – 150 ppm; 4 hr – 96 ppm; 8 hr – 63 ppm

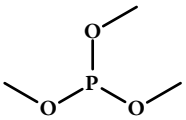
Properties:

MW: 110.1	*VP:* 2.5 mmHg (100°F)	*FlP:* 158°F
D: 1.2 g/mL	*VD:* 3.8	*LEL:* —
MP: –76°F	*Vlt:* 3,100 ppm (100°F)	*UEL*: —
BP: 338°F	*ER:* —	*RP:* 4.0
Vsc: —	*H_2O:* Soluble	*IP:* 10.53 eV
	Sol: Most organic solvents	

C01-C086

Trimethyl Phosphite

CAS: 121-45-9
RTECS: TH1400000
UN: 2329; 130
EC: 204-471-5
UNII: 26Q0321ZDG
ICD-11: —



C_3 H_9 O_3 P

Colorless liquid with a distinctive, pungent, irritating, oily odor that smells like pyridine at higher concentrations. The odor is detectable at ≥0.1 ppb. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts.

Used industrially as a chemical intermediate in the manufacture of pesticides and phosphosilicate glass. Used as a gasoline additive, catalyst, and as a fireproofing agent in the production of textiles and flame-retardant polymers for polyurethane foams.

This material is on Schedule 3 of the CWC, the Australia Group Export Control list, DHS Chemicals of Interest list, and Australia Chemicals of Security Concern list.

This material is a general precursor for nerve agents.

Exposure Hazards

Conversion Factor: 1 ppm = 5.08 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 6.1 ppm; Mar: 61 ppm; Crit: 310 ppm; Cat: —
PAC-1: 6.1 ppm; *PAC-2:* 61 ppm; *PAC-3:* 310 ppm
REL: 2 ppm
TLV: 2 ppm

Interim AEGLs
AEGL-1: 1 hr – 6.1 ppm; 4 hr – 3.8 ppm; 8 hr – 2.5 ppm
AEGL-2: 1 hr – 61 ppm; 4 hr – 38 ppm; 8 hr – 25 ppm
AEGL-3: 1 hr – 310 ppm; 4 hr – 160 ppm; 8 hr – 81 ppm

Properties:

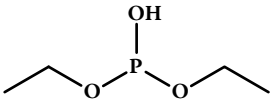
MW: 124.1	*VP:* 24 mmHg (77°F)	*FlP:* 82°F
D: 1.1 g/mL	*VD:* 4.3	*LEL:* —
MP: –108°F	*Vlt:* 32,000 ppm (77°F)	*UEL*: —

BP: 232°F	*ER:* —	*RP:* 0.38
Vsc: —	*H_2O:* Reacts	*IP:* 9.21 eV
	Sol: Hydrocarbons, ethanol, ether, acetone	

C01-C087

Diethyl Phosphite

CAS: 762-04-9
RTECS: TG7875000
UN: —
EC: 212-091-6
UNII: U9X9YBA22W
ICD-11: —



$C_4\ H_{11}\ O_3\ P$

Specific information is not available for this agent. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts.

Used industrially as a textile finishing agent, antioxidant, paint solvent, additive for adhesives, additive for extreme pressure lubricant; chemical intermediate for organic phosphorus compounds

This material is on Schedule 3 of the CWC, the Australia Group Export Control list, DHS Chemicals of Interest list, and Australia Chemicals of Security Concern list.

This material is a general precursor for nerve agents. This material has been used as a simulant for nerve agents in government tests.

Exposure Hazards

Conversion Factor: 1 ppm = 5.65 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 8.8 ppm; Mar: 62 ppm; Crit: 88 ppm; Cat: —
PAC-1: 2.1 ppm; *PAC-2:* 23 ppm; *PAC-3:* 140 ppm

Properties:

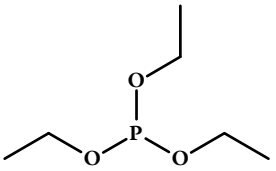
MW: 138.1	*VP:* 11.2 mmHg (77°F)	*FlP:* 180°F
D: 1.1 g/mL	*VD:* 4.8	*LEL:* 3.8%
MP: —	*Vlt:* —	*UEL*: 12.8%
BP: 160°F (10 mmHg)	*ER:* —	*RP:* —
Vsc: —	*H_2O:* 11% (est.)	*IP:* 10.31 eV
	Sol: —	

C01-C088

Triethyl Phosphite

CAS: 122-52-1
RTECS: TH1130000
UN: 2323; 130
EC: 204-552-5

UNII: 6B2R04S55G
ICD-11: —



$C_6\ H_{15}\ O_3\ P$

Colorless liquid with a strong foul odor. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

Used industrially as a plasticizer; vinyl stabilizer; grease additive; color inhibitor for resins; and as a chemical intermediate for insecticides. Used in agriculture to ripen sugarcane.

This material is on the Australia Group Export Control list and Schedule 3 of the CWC.

This material is a general precursor for nerve agents. This material has been used as a simulant for nerve agents in government tests.

Exposure Hazards

Conversion Factor: 1 ppm = 6.80 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 5.9 ppm; Mar: 44 ppm; Crit: 220 ppm; Cat: —
PAC-1: 1.3 ppm; *PAC-2:* 14 ppm; *PAC-3:* 82 ppm

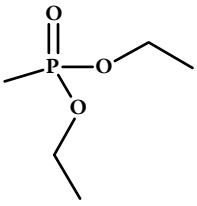
Properties:

MW: 166.2	*VP:* 1.95 mmHg	*FlP:* 130°F
D: 0.97 g/mL	*VD:* 5.7	*LEL:* 3.8%
MP: –94°F	*Vlt:* 2,600 ppm	*UEL*: 43%
BP: 313°F	*ER:* —	*RP:* 3.9
Vsc: —	*H_2O:* Insoluble	*IP:* 8.40 eV
	Sol: Ethanol, ether	

C01-C089

Diethyl Methylphosphonate

CAS: 683-08-9
RTECS: SZ9085000
UN: —
EC: 211-667-4
UNII: —
ICD-11: —



$C_5\ H_{13}\ O_3\ P$

Clear, colorless liquid. This material is hazardous through inhalation and produces local skin/eye impacts.

Used in organic synthesis.

This material is on Schedule 2 of the CWC and the Australia Group Export Control list.

This material is a general precursor for nerve agents. It is also commonly found as a decomposition product/impurity and degradation product from hydrolysis of nerve agents.

Exposure Hazards

Conversion Factor: 1 ppm = 6.22 mg/m^3 at 77°F
MEG$_{(1hr)}$: Neg: 4.0 ppm; Mar: 32 ppm; Crit: 80 ppm; Cat: —
PAC-1: 1.2 ppm; *PAC-2:* 13 ppm; *PAC-3:* 77 ppm

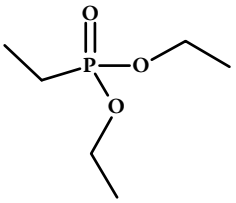
Properties:

MW: 152.1	*VP:* 0.01 mmHg	*FlP:* 167°F
D: 1.0 g/mL	*VD:* 5.2	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 374°F	*ER:* —	*RP:* —
Vsc: —	*H_2O:* —	*IP:* —
	Sol: —	

C01-C090

Diethyl Ethylphosphonate

CAS: 78-38-6
RTECS: SZ7925000
UN: —
EC: 201-111-9
UNII: Y52Q01P44T
ICD-11: —



$C_6\ H_{15}\ O_3\ P$

Colorless liquid with a sweet odor. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

Used industrially as a solvent to extract heavy metals, a gasoline additive, antifoam agent, plasticizer, chelating agent, and as a textile conditioner and antistatic agent.

This material is on Schedule 2 of the CWC, the Australia Group Export Control list and DHS Chemicals of Interest list.

This material is a general precursor for nerve agents. It is also commonly found as a decomposition product/impurity and degradation product from hydrolysis of some nerve agents.

Exposure Hazards

Conversion Factor: 1 ppm = 6.80 mg/m^3 at 77°F

$MEG_{(1hr)}$: Neg: 0.90 ppm; Mar: 5.9 ppm; Crit: 74 ppm; Cat: —

PAC-1: 0.15 ppm; *PAC-2:* 1.6 ppm; *PAC-3:* 68 ppm

Properties:

MW: 166.2	*VP:* 0.07 mmHg	*FlP:* 221°F
D: 1.0 g/mL	*VD:* 5.7	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 388°F	*ER:* —	*RP:* —
Vsc: —	*H_2O:* Slight	*IP:* —
	Sol: Most organic solvents	

C01-C091

Diethyl Isopropylphosphonate

CAS: 1538-69-8

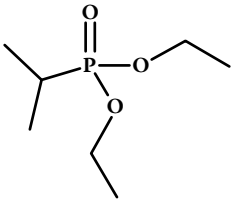
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



$C_7\ H_{17}\ O_3\ P$

Clear, colorless liquid with an alcohol-like odor. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

This material is on Schedule 2 of the CWC.

This material is a general precursor for nerve agents. It is also commonly found as a decomposition product/impurity and degradation product from hydrolysis of some nerve agents.

Exposure Hazards

Conversion Factor: 1 ppm = 7.37 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

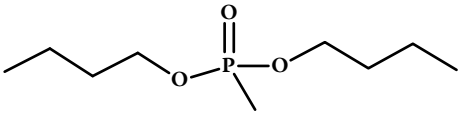
Properties:

MW: 180.2	*VP:* —	*FlP:* —
D: 0.67 g/mL	*VD:* 6.2	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 138°F (25 mmHg)	*H_2O:* —	*RP:* —
Vsc: —	*Sol:* —	*IP:* —

C01-C092

Dibutyl Methylphosphonate

CAS: 2404-73-1
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_9\ H_{21}\ O_3\ P$

Liquid. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

This material is on Schedule 2 of the CWC.

This material is a general precursor for nerve agents.

Exposure Hazards

Conversion Factor: 1 ppm = 8.52 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

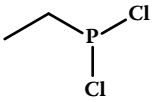
Properties:

MW: 208.2	*VP:* 0.011 mmHg (77°F)	*FlP:* 262°F
D: —	*VD:* 7.2	*LEL:* —
MP: —	*Vlt:* 14 ppm	*UEL*: —
BP: 508°F	*H_2O:* 0.8% (77°F)	*RP:* 660
Vsc: —	*Sol:* —	*IP:* —

C01-C093

Ethyldichlorophospine

CAS: 1498-40-4
RTECS: TB2465000
UN: —
EC: 216-096-4
UNII: —
ICD-11: —



$C_2\ H_5\ Cl_2\ P$

Colorless to yellow liquid with a strong disagreeable odor (stench). This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts.

Used industrially for organic synthesis.

This material is on Schedule 2 of the CWC and the Australia Group Export Control list.

This material is a general precursor for nerve agents.

Exposure Hazards

Conversion Factor: 1 ppm = 5.36 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

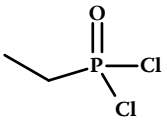
Properties:

MW: 130.9	*VP:* —	*FlP:* 90°F
D: 1.3 g/mL	*VD:* 4.5	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 239°F	*H_2O:* Reacts	*RP:* —
Vsc: —	*Sol:* —	*IP:* 9.30 eV

C01-C094

Ethylphosphonyl Dichloride

CAS: 1066-50-8
RTECS: TA1780000
UN: —
EC: 213-918-3
UNII: —
ICD-11: —



C_2 H_5 Cl_2 O P

Clear colorless to light yellow liquid. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Used industrially for organic synthesis.

This material is on Schedule 2 of the CWC, the Australia Group Export Control list, DHS Chemicals of Interest list, and ITF-25 low threat lists.

This material is a precursor for general nerve agents.

Exposure Hazards

Conversion Factor: 1 ppm = 6.01 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

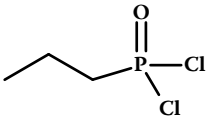
Properties:

MW: 146.9	*VP:* —	*FlP:* 235°F
D: 1.4 g/mL	*VD:* 5.1	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 216°F (68 mmHg)	*H_2O:* Reacts	*RP:* —
Vsc: —	*Sol:* —	*IP:* —

C01-C095

Propylphosphonic Dichloride

CAS: 4708-04-7
RTECS: —
UN: —
EC: 225-195-1
UNII: —
ICD-11: —



$C_3\ H_7\ Cl_2\ O\ P$

Clear yellow liquid. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

This material is on Schedule 2 of the CWC.

This material is a general precursor for nerve agents.

Exposure Hazards

Conversion Factor: 1 ppm = 6.58 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

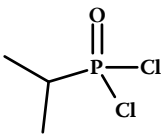
Properties:

MW: 161.0	*VP:* —	*FlP:* 235°F
D: 1.3 g/mL	*VD:* 5.6	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 190°F (50 mmHg)	*H_2O:* Reacts	*RP:* —
Vsc: —	*Sol:* —	*IP:* —

C01-C096

2-Propanephosphonyl Chloride

CAS: 1498-46-0
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_3\ H_7\ Cl_2\ O\ P$

Colorless liquid. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts.

This material is on Schedule 2 of the CWC.

This material is a general precursor for nerve agents.

Exposure Hazards

Conversion Factor: 1 ppm = 6.58 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

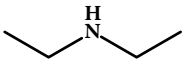
Properties:

MW: 161.0	*VP:* 1.14 mmHg (77°F)	*FlP:* 147°F
D: 1.3 g/mL	*VD:* 5.6	*LEL:* —
MP: —	*Vlt:* 1,500 ppm	*UEL*: —
BP: 176°F (20 mmHg)	*H_2O:* Reacts	*RP:* 7.0
Vsc: —	*Sol:* —	*IP:* —

C01-C097

Diethylamine

CAS: 109-89-7; 660-68-4 (Hydrochloride salt); 6274-12-0 (Hydrobromide salt)
RTECS: HZ8750000
UN: 1154; 132
EC: 203-716-3
UNII: B035PIS86W; ZE9V3G1135 (Hydrochloride salt);
ICD-11: —



C_4 H_{11} N

Clear colorless liquid with a fishy, ammonia-like odor. Various salts (solids) have been reported. This material produces local skin/eye impacts.

Used industrially in the production of rubber chemicals, textile specialties, dyes, resins, pharmaceuticals, and pesticides. Used as a selective solvent, flotation agent, polymerization inhibitor, corrosion inhibitor, and buffer.

This material is on the Australia Group Export Control list.

Exposure Hazards

Conversion Factor: 1 ppm = 2.99 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 13 ppm; Mar: 67 ppm; Crit: 200 ppm; Cat: —
PAC-1: 15 ppm; *PAC-2:* 330 ppm; *PAC-3:* 2,000 ppm
PEL: 25 ppm
REL: 10 ppm
TLV: 5 ppm
$STEL_{(ACGIH)}$: 15 ppm
$STEL_{(NIOSH)}$: 25 ppm
IDLH: 200 ppm

Properties:

MW: 73.1	*VP:* 192 mmHg	*FlP:* –15°F
D: 0.71 g/mL	*VD:* 2.5	*LEL:* 1.8%
MP: –58°F	*Vlt:* 250,000 ppm	*UEL*: 10.1%
BP: 132°F	*ER:* 230	*RP:* 0.06
Vsc: 0.48 cS	*H_2O:* Miscible	*IP:* 8.00 eV
	Sol: Miscible in most organic solvents	

C01-C098

Dimethylamine

CAS: 124-40-3; 506-59-2 (Hydrochloride salt)
RTECS: IP8750000
UN: 1032; 118
EC: 204-697-4
UNII: ARQ8157E0Q; 7M4CWB6AOK (Hydrochloride salt)
ICD-11: XM0EE9



C_2 H_7 N

Colorless gas with an ammonia or fish like odor detectable at ≥0.53 ppm. Shipped as a liquefied compressed gas. Various salts have been reported. This material is hazardous through inhalation and produces local skin/eye impacts.

Used industrially for manufacture of detergents, pesticides, and pharmaceuticals. Used as a gasoline additive and solvent.

This material is on the Australia Group Export Control list and DHS Chemicals of Interest list.

This material is a precursor for some G-series, GV-series and V-series nerve agents and is also commonly found as a decomposition product/impurity resulting from hydrolysis of tabun (C01-A001).

Exposure Hazards

Conversion Factor: 1 ppm = 1.84 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 9.8 ppm; Mar: 65 ppm; Crit: 250 ppm; Cat: —
PAC-1: 9.8 ppm; *PAC-2:* 65 ppm; *PAC-3:* 250 ppm
PEL: 10 ppm
REL: 10 ppm
TLV: 5 ppm
$STEL_{(ACGIH)}$: 15 ppm
IDLH: 500 ppm

Interim AEGLs
AEGL-1: 1 hr – 10 ppm; 4 hr – 10 ppm; 8 hr – 10 ppm
AEGL-2: 1 hr – 66 ppm; 4 hr – 40 ppm; 8 hr – 32 ppm
AEGL-3: 1 hr – 250 ppm; 4 hr – 150 ppm; 8 hr – 120 ppm

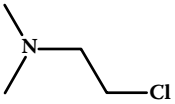
Properties:

MW: 45.1	*VP:* 1,300 mmHg	*FlP:* 20°F
D: 0.67 g/mL (liq. gas, 44°F)	*VD:* 1.6	*LEL:* 2.8%
MP: –134°F	*Vlt:* —	*UEL*: 14.4%
BP: 44°F	*ER:* 210	*RP:* 0.001
Vsc: —	*H_2O:* 24% (140°F)	*IP:* 8.24 eV
	Sol: Alcohols, ether	

C01-C099

Dimethylaminoethyl Chloride

CAS: 107-99-3; 4584-46-7 (Hydrochloride salt); 69153-76-0 (Sulfate salt)
RTECS: KQ9020000
UN: —
EC: 203-540-7
UNII: 9UK81G2OHJ
ICD-11: —



C_4 H_{10} Cl N

Oil is unstable and decomposes on storage. Hydrochloride is colorless to light beige crystalline powder with a characteristic odor. Various salts (solids) have been reported. This material is hazardous through inhalation, ingestion, and produces local skin/eye impacts.

This material is on Schedule 2 of the CWC.

This material is a precursor for some GV-series and V-series nerve agents.

Exposure Hazards

Conversion Factor: 1 ppm = 4.40 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 107.6	*VP:* 214 mmHg	*FlP:* 12°F
D: 0.95 g/mL	*VD:* 3.7	*LEL:* —
MP: —	*Vlt:* 290,000 ppm	*UEL*: —
BP: 136°F	*H_2O:* Reacts	*RP:* 0.045
Vsc: —	*ER:* 210	*IP:* —
	Sol: —	

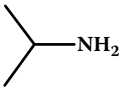
Hydrochloride Salt

MW: 144.1
MP: 397°F
H_2O: 200%

C01-C100

Isopropylamine

CAS: 75-31-0; 15572-56-2 (Hydrochloride salt)
RTECS: NT8400000
UN: 1221; 132
EC: 200-860-9
UNII: P8W26T4MTD
ICD-11: —



C_3 H_9 N

Colorless to yellow liquid with a fish-like, ammonia odor. Various salts (solids) have been reported. This material is hazardous through inhalation and produces local skin/eye impacts.

Used industrially as a solvent, in producing rubber, medicines, dyes, insecticides, textiles in tanning hides, and as a food additive.

This material is the DHS Chemicals of Interest list.

Exposure Hazards

Conversion Factor: 1 ppm = 2.42 mg/m^3 at 77°F
Eye, Nose & Throat Irritation: 10 – 20 ppm for a brief exposure
MEG$_{(1hr)}$: Neg: 10 ppm; Mar: 120 ppm; Crit: 620 ppm; Cat: —
PAC-1: 9.9 ppm; *PAC-2:* 660 ppm; *PAC-3:* 4,000 ppm
PEL: 5 ppm
TLV: 5 ppm
STEL$_{(ACGIH)}$: 10 ppm
IDLH: 750 ppm

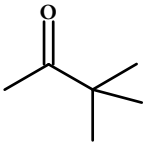
Properties:

MW: 59.1	*VP:* 460 mmHg	*FlP:* –35°F
D: 0.69 g/mL	*VD:* 2.0	*LEL:* 2%
MP: –150°F	*Vlt:* 620,000 ppm	*UEL*: 10.4%
BP: 91°F	*ER:* 280	*RP:* 0.028
Vsc: 0.47 cS	*H_2O:* Miscible	*IP:* 8.72 eV
	Sol: Ethanol, ether, acetone	

C01-C101

Methyl t-Butyl Ketone

CAS: 75-97-8
RTECS: EL7700000
UN: —
EC: 200-920-4
UNII: —
ICD-11: —



$C_6 H_{12} O$

Colorless liquid with an odor like peppermint or camphor. This material is hazardous through inhalation, skin absorption, and ingestion.

Used industrially for manufacture of fungicides and herbicides.

This material is on the Australia Group Export Control list.

This material can be reduced to pinacolyl alcohol (C01-C102), which is an intermediate for production of soman (C01-A003).

Exposure Hazards

Conversion Factor: 1 ppm = 4.10 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 4.9 ppm; Mar: 180 ppm; Crit: 980 ppm; Cat: —
PAC-1: 0.44 ppm; *PAC-2:* 4.9 ppm; *PAC-3:* 29 ppm

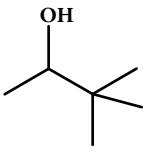
Properties:

MW: 100.2	*VP:* 31.5 mmHg (77°F)	*FlP:* 63°F
D: 0.72 g/mL (77°F)	*VD:* 3.5	*LEL:* —
MP: –63°F	*Vlt:* 41,000 ppm (77°F)	*UEL*: —
BP: 223°F	*ER:* —	*RP:* 0.32 (77°F)
Vsc: 3.4 cs (-63°F)	H_2O: 2.4% (59°F)	*IP:* 9.14 eV
	Sol: Alcohols, ether, acetone	

C01-C102

Pinacolyl Alcohol

CAS: 464-07-3
RTECS: EL2276000
UN: —
EC: 207-347-9
UNII: 5BV6T1107J
ICD-11: —



$C_6 H_{14} O$

Clear, colorless to light yellow liquid. Hazardous routes of exposure for this material have not been established.

Used industrially for organic synthesis and as a flavoring agent for foods.

This material is on Schedule 2 of the CWC, the Australia Group Export Control list and DHS Chemicals of Interest list.

This material is an intermediate for production of soman (C01-A003).

Exposure Hazards

Conversion Factor: 1 ppm = 4.81 mg/m^3 at 77°F
MEG$_{(1hr)}$: Neg: —; Mar: —; Crit: 730 ppm; Cat: —
PAC-1: 1.7 ppm; *PAC-2:* 19 ppm; *PAC-3:* 110 ppm

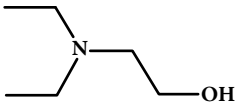
Properties:

MW: 102.2	*VP:* 8.81 mmHg (77°F)	*FlP:* 82°F
D: 0.81 g/mL	*VD:* 3.5	*LEL:* —
MP: 41°F	*Vlt:* 12,000 ppm (77°F)	*UEL*: —
BP: 246°F	*ER:* —	*RP:* 1.1 (77°F)
Vsc: —	*H_2O:* 2.4% (77°F)	*IP:* 10.14 eV
	Sol: Ethanol, ethyl ether	

C01-C103

Diethylaminoethanol

CAS: 100-37-8
RTECS: KK5075000
UN: 2686; 132
EC: 202-845-2
UNII: S6DL4M053U
ICD-11: —



C_6 H_{15} N O

Colorless hygroscopic liquid with a nauseating odor similar to ammonia detectable at ≥0.011 ppm – 0.04 ppm. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

Used industrially for the manufacture of emulsifying agents, flocculants, soaps, textiles softeners, cosmetics, in pharmaceuticals and crop protection agents, in the preparation of chemicals for the paper and leather industries, and in the production of plastics.

This material is on the Australia Group Export Control list.

This material is a precursor for production of GV and V series nerve agents.

Exposure Hazards

Conversion Factor: 1 ppm = 4.79 mg/m^3 at 77°F
MEG$_{(1hr)}$: Neg: 4.8 ppm; Mar: 21 ppm; Crit: 100 ppm; Cat: —
PAC-1: 6.1 ppm; *PAC-2:* 84 ppm; *PAC-3:* 500 ppm
PEL: 10 ppm [Skin]
REL: 10 ppm [Skin]
TLV: 2 ppm [Skin]
IDLH: 100 ppm

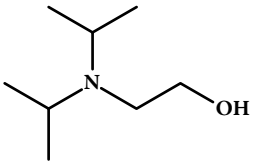
Properties:

MW: 117.2	*VP:* 1.4 mmHg	*FlP:* 140°F
D: 0.89 g/mL	*VD:* 4.0	*LEL:* 6.7%
MP: –94°F	*Vlt:* 1,900 ppm	*UEL*: 11.7%
BP: 325°F	ER: —	*RP:* 6.6
Vsc: 5.6 cs	H_2O: Miscible	*IP:* 8.58 eV
	Sol: Alcohols, acetone, ether, benzene	

C01-C104

2-(Diisopropylamino)ethanol

CAS: 96-80-0; 63051-68-3 (Hydrochloride salt)
RTECS: KK5950000
UN: —
EC: 202-536-2
UNII: DK7FND4TJZ
ICD-11: —



C_8 H_{19} N O

Clear colorless liquid with a nauseating odor similar to ammonia. Various salts (solids) have been reported. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

Used industrially as a catalyst; emulsifying agent; and for manufacture of pharmaceuticals.

This material is on Schedule 2 of the CWC, the Australia Group Export Control list and DHS Chemicals of Interest list.

This material is an intermediate for production of VX (C01-A017) and is also commonly found as a decomposition product resulting from hydrolysis of VX.

Exposure Hazards

Conversion Factor: 1 ppm = 5.94 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 1.3 ppm; Mar: 8.4 ppm; Crit: 42 ppm; Cat: —
PAC-1: 0.25 ppm; *PAC-2:* 2.9 ppm; *PAC-3:* 17 ppm

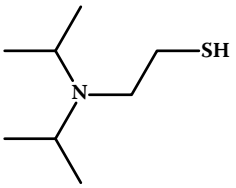
Properties:

MW: 145.2	*VP:* 1.8 mmHg	*FlP:* 175°F
D: 0.83 g/mL	*VD:* 5.0	*LEL:* —
MP: –39°F	*Vlt:* 2,400 ppm	*UEL*: —
BP: 374°F	*ER:* —	*RP:* 4.6
Vsc: —	H_2O: 1%	*IP:* —
	Sol: —	

C01-C105

Diisopropylaminoethanethiol

CAS: 5842-07-9; 41480-75-5 (Hydrochloride salt); 172201-89-7 (Sodium salt)
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_8\ H_{19}\ N\ S$

Yellow liquid. Various salts (solids) have been reported. This material produces local skin/eye impacts.

This material is on Schedule 2 of the CWC, the Australia Group Export Control list, and DHS Chemicals of Interest list.

This material is a degradation product from hydrolysis of VX (C01-A017).

Exposure Hazards

Conversion Factor: 1 ppm = 6.60 mg/m^3 at 77°F
PAC-1: ppm; *PAC-2:* ppm; *PAC-3:* ppm
PAC-1: 0.016 mg/m^3; *PAC-2:* 0.18 mg/m^3; *PAC-3:* 1.1 mg/m^3

Properties:

MW: 161.3	*VP:* —	*FlP:* 157°F
D: 0.86 g/mL	*VD:* 5.6	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 376°F	*ER:* —	*RP:* —
Vsc: —	*H_2O:* —	*IP:* —
	Sol: —	

C01-C106

Sodium Hexafluoosilicate

CAS: 16893-85-9
RTECS: VV8410000
UN: 2674; 154
EC: 240-934-8
UNII: 806AV2E065
ICD-11: —

Na_2SiF_6

Fine, white, odorless crystalline powder. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts.

Used industrially in the manufacture of pure silicon, laundry soaps, opalescent glass, enamels for china and porcelain, as a leather and wood preservative, insecticides, moth repellent and rodenticide, and in the fluoridation of drinking water.

This material is on the Australia Group Export Control List.

Exposure Hazards

Conversion Factor: 1 ppm = 7.69 mg/m^3 at 77°F
MEG$_{(1hr)}$: Neg: 4.1 mg/m^3; Mar: —; Crit: 5.0 mg/m^3; Cat: —
PAC-1: 12 mg/m^3; *PAC-2:* 140 mg/m^3; *PAC-3:* 820 mg/m^3
OSHA PEL: 2.5 mg/m^3 (as fluorine)

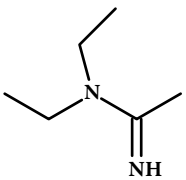
Properties:

MW: 188.1	*VP:* —	*FlP:* NA
D: 2.7 g/cm^3	*VD:* —	*LEL:* NA
MP: Decomposes	*Vlt:* —	*UEL*: NA
BP: —	*ER:* —	*RP:* —
Vsc: —	*H_2O:* 0.64%	*IP:* —
	Sol: Insoluble in alcohols	

C01-C107

N,N-Diethylethanimidamide

CAS: 14277-06-6
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



C_6 H_{14} N_2

Specific information is not available for this material.

This material is on the Australia Group Control list.

This material is a component and binary precursor for various novichok agents.

Exposure Hazards

Conversion Factor: 1 ppm = 4.67 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

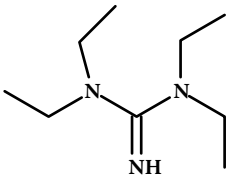
MW: 114.2	*VP:* 13.5 mmHg (77°F)	*FlP:* —
D: 0.9 g/mL	*VD:* 3.9	*LEL:* —
MP: —	*Vlt:* 17,760 ppm	*UEL*: —

BP: —	*ER:* —	*RP:* 0.7
Vsc: —	*H_2O:* —	*IP:* —
	Sol: —	

C01-C108

1,1,3,3-Tetraethylguanidine

CAS: 13439-87-7
RTECS: —
UN: —
EC: —
UNII: VEZ101E7ZU
ICD-11: —



$C_9\ H_{21}\ N_3$

Specific information is not available for this material

This material is a component and binary precursor for various novichok agents.

Exposure Hazards

Conversion Factor: 1 ppm = 7.01 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

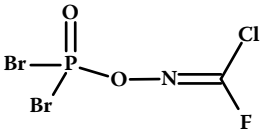
Properties:

MW: 171.3	*VP:* 0.0274mmHg (77°F)	*FlP:* 217°F
D: 0.89 g/mL	*VD:* 5.9	*LEL:* —
MP: —	*Vlt:* 36 ppm	*UEL*: —
BP: 475°F	*ER:* —	*RP:* 280
Vsc: —	*H_2O:* —	*IP:* —
	Sol: —	

C01-C109

[(Dibromophosphinyl)oxy]carbonimidic Chloride Fluoride

CAS: 18262-26-5
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



C Br_2 Cl F N O_2 P

Specific information is not available for this material. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

This material is a precursor for the oxime-series agents.

Exposure Hazards

Conversion Factor: 1 ppm = 12.40 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 303.3	*VP:* 0.03 mmHg (77°F) (est.)	*FlP:* —
D: 2.2 g/mL	*VD:* 10	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 140°F (0.1 mmHg)	*H_2O:* Sparingly soluble	*RP:* —
Vsc: —	*Sol:* —	*IP:* —

C01-C110

[(Dichlorophosphinyl)oxy]carbonimidic Difluoride

CAS: 18262-24-3

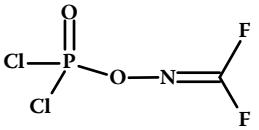
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



C Cl_2 F_2 N O_2 P

Specific information is not available for this material. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

This material is a precursor for the oxime-series agents.

Exposure Hazards

Conversion Factor: 1 ppm = 8.09 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 197.9	*VP:* 0.9 mmHg (77°F) (est.)	*FlP:* —
D: 1.6 g/mL	*VD:* 6.8	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 149°F (20 mmHg)	*H_2O:* Slight	*RP:* —
Vsc: —	*Sol:* —	*IP:* —

C01-C111

[(Dichlorophosphinyl)oxy]carbonimidic Chloride Fluoride

CAS: 18425-23-5

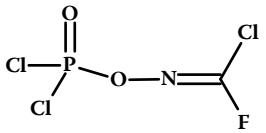
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



C Cl_3 F N O_2 P

Specific information is not available for this material. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

This material is a precursor for the oxime-series agents.

Exposure Hazards

Conversion Factor: 1 ppm = 8.77 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 214.4	*VP:* 0.2 mmHg (77°F) (est.)	*FlP:* —
D: 1.7 g/mL	*VD:* 7.4	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 142°F (6 mmHg)	*H_2O:* Sparingly soluble	*RP:* —
Vsc: —	*Sol:* —	*IP:* —

C01-C112

[(Dichlorophosphinyl)oxy]carbonimidic Dichloride

CAS: 17642-35-2

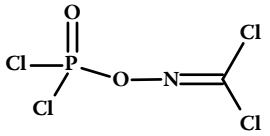
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



$C\ Cl_4\ N\ O_2\ P$

Specific information is not available for this material. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

This material is a precursor for the oxime-series agents.

Exposure Hazards

Conversion Factor: 1 ppm = 9.44 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 230.8	*VP:* 0.04 mmHg (77°F) (est.)	*FlP:* —
D: 1.7 g/mL	*VD:* 8.0	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 167°F (5 mmHg)	*H_2O:* Sparingly soluble	*RP:* —
Vsc: —	*Sol:* —	*IP:* —

C01-C113

N-[(Dichlorophosphinyl)oxy]-2,2-difluoro-2-nitroethanimidoyl Fluoride

CAS: 18262-25-4

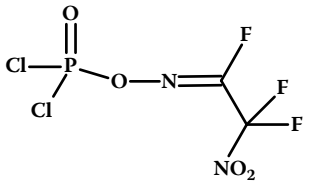
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



$C_2\ Cl_2\ F_3\ N_2\ O_4\ P$

Specific information is not available for this material. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

This material is a precursor for the oxime-series agents.

Exposure Hazards

Conversion Factor: 1 ppm = 11.24 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 274.9	*VP:* 0.08 mmHg (77°F) (est.)	*FlP:* —
D: 1.7 g/mL	*VD:* 9.5	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 149°F (3 mmHg)	*H_2O:* Sparingly soluble	*RP:* —
Vsc: —	*Sol:* —	*IP:* —

C01-C114

2-Chloro-N-[(dichlorophosphinyl)oxy]ethanimidoyl Chloride

CAS: 111203-62-4

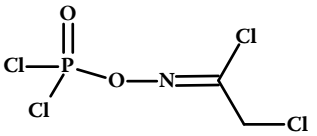
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



C_2 H_2 Cl_4 N O_2 P

Specific information is not available for this material. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

This material is a precursor for the oxime-series agents.

Exposure Hazards

Conversion Factor: 1 ppm = 10.01 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 244.8	*VP:* 0.01 mmHg (77°F) (est.)	*FlP:* —
D: —	*VD:* 8.4	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 210°F (2 mmHg)	*H_2O:* Sparingly soluble	*RP:* —
Vsc: —	*Sol:* —	*IP:* —

C01-C115

[(Chloromethoxyphosphinyl)oxy]carbonimidic Chloride Fluoride

CAS: 17650-48-5

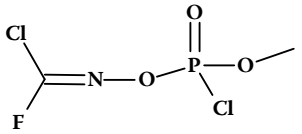
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



$C_2\ H_3\ Cl_2\ F\ N\ O_3\ P$

Specific information is not available for this material. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

This material is a precursor for the oxime-series agents.

Exposure Hazards

Conversion Factor: 1 ppm = 8.58 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 209.9	*VP:* 0.5 mmHg (77°F) (est.)	*FlP:* —
D: 1.6 g/mL	*VD:* 7.2	*LEL:* —
MP: —	*Vlt:* —	*UEL:* —
BP: 203°F (6 mmHg)	*H_2O:* Sparingly soluble	*RP:* —
Vsc: —	*Sol:* —	*IP:* —

C01-C116

N-[(Dichlorophosphinyl)oxy]ethanimidoyl Chloride

CAS: 120932-13-0

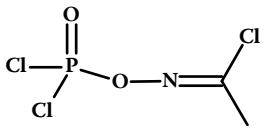
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



$C_2\ H_3\ Cl_3\ N\ O_2\ P$

Specific information is not available for this material. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

This material is a precursor for the oxime-series agents.

Exposure Hazards

Conversion Factor: 1 ppm = 8.61 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

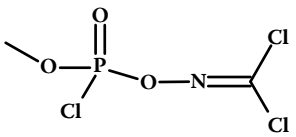
MW: 210.4	*VP:* 0.1 mmHg (77°F) (est.)	*FlP:* —
D: —	*VD:* 7.3	*LEL:* —

MP: —	*Vlt:* —	*UEL*: —
BP: 160°F (2 mmHg)	*H_2O:* Sparingly soluble	*RP:* —
Vsc: —	*Sol:* —	*IP:* —

C01-C117

[(Chloromethoxyphosphinyl)oxy]carbonimidic Dichloride

CAS: 17642-33-0
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



C_2 H_3 Cl_3 N O_3 P

Specific information is not available for this material. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

This material is a precursor for the oxime-series agents.

Exposure Hazards

Conversion Factor: 1 ppm = 9.26 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

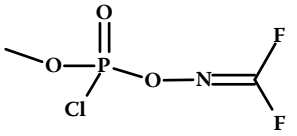
Properties:

MW: 226.4	*VP:* 0.1 mmHg (77°F) (est.)	*FlP:* —
D: 1.6 g/mL	*VD:* 7.8	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 180°F (1 mmHg)	*H_2O:* Sparingly soluble	*RP:* —
Vsc: —	*Sol:* —	*IP:* —

C01-C118

[(Chloromethoxyphosphinyl)oxy]carbonimidic Difluoride

CAS: 18262-30-1
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



C_2 H_3 Cl F_2 N O_3 P

Specific information is not available for this material. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

This material is a precursor for the oxime-series agents.

Exposure Hazards

Conversion Factor: 1 ppm = 7.91 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 193.5	*VP:* 2 mmHg (77°F) (est.)	*FlP:* —
D: 1.5 g/mL	*VD:* 6.7	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 138°F (2 mmHg)	*H_2O:* Sparingly soluble	*RP:* —
Vsc: —	*Sol:* —	*IP:* —

C01-C119

2,2-Dichloro-N-[(dichlorophosphinyl)oxy]ethanimidoyl Chloride

CAS: 114700-94-6

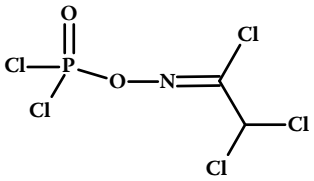
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



C_2 H Cl_5 N O_2 P

Specific information is not available for this material. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

This material is a precursor for the oxime-series agents.

Exposure Hazards

Conversion Factor: 1 ppm = 11.42 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 279.3	*VP:* 0.008 mmHg (77°F) (est.)	*FlP:* —
D: —	*VD:* 9.6	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 201°F (1.5 mmHg)	H_2O: Sparingly soluble	*RP:* —
Vsc: —	*Sol:* —	*IP:* —

C01-C120

N-[(Chloromethoxyphosphinyl)oxy]-2,2-difluoro-2-nitroethanimidoyl Fluoride

CAS: 18262-33-4

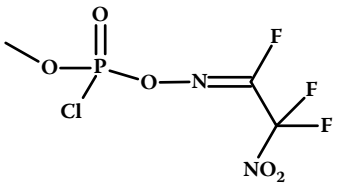
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



C_3 H_3 Cl F_3 N_2 O_5 P

Specific information is not available for this material. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

This material is a precursor for the oxime-series agents.

Exposure Hazards

Conversion Factor: 1 ppm = 11.06 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 270.5	*VP:* 0.2 mmHg (77°F) (est.)	*FlP:* —
D: 1.6 g/mL	*VD:* 9.3	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 189°F (3 mmHg)	H_2O: Sparingly soluble	*RP:* —
Vsc: —	*Sol:* —	*IP:* —

C01-C121

[(Chloro-2-chloroethoxyphosphinyl)oxy]carbonimidic Chloride Fluoride

CAS: 23233-25-2

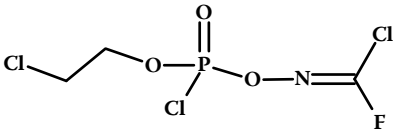
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



$C_3\ H_4\ Cl_3\ F\ N\ O_3\ P$

Specific information is not available for this material. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

This material is a precursor for the oxime-series agents.

Exposure Hazards

Conversion Factor: 1 ppm = 10.57 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

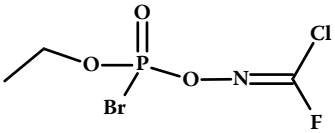
Properties:

MW: 258.4	*VP:* 0.01 mmHg (77°F) (est.)	*FlP:* —
D: 1.6 g/mL	*VD:* 8.9	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 163°F (0.01 mmHg)	*H_2O:* Sparingly soluble	*RP:* —
Vsc: —	*Sol:* —	*IP:* —

C01-C122

[(Bromoethoxyphosphinyl)oxy]carbonimidic Chloride Fluoride

CAS: 17642-25-0
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_3\ H_5\ Br\ Cl\ F\ N\ O_3\ P$

Specific information is not available for this material. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

This material is a precursor for the oxime-series agents.

Exposure Hazards

Conversion Factor: 1 ppm = 10.98 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 268.4	*VP:* 0.07 mmHg (77°F) (est.)	*FlP:* —
D: 1.7 g/mL	*VD:* 9.3	*LEL:* —

MP: —	*Vlt:* —	*UEL*: —
BP: 214°F (1 mmHg)	*H_2O:* Sparingly soluble	*RP:* —
Vsc: —	*Sol:* —	*IP:* —

C01-C123

[(Chloroethoxyphosphinyl)oxy]carbonimidic Chloride Fluoride

CAS: 18262-27-6

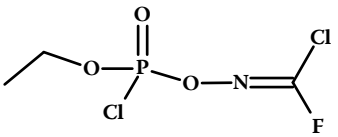
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



C_3 H_5 Cl_2 F N O_3 P

Specific information is not available for this material. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

This material is a precursor for the oxime-series agents.

Exposure Hazards

Conversion Factor: 1 ppm = 9.16 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 224.0	*VP:* 0.2 mmHg (77°F) (est.)	*FlP:* —
D: 1.4 g/mL	*VD:* 7.2	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 170°F (3 mmHg)	*H_2O:* Sparingly soluble	*RP:* —
Vsc: —	*Sol:* —	*IP:* —

C01-C124

N-[(Dichlorophosphinyl)oxy]propanimidoyl Chloride

CAS: 121951-54-0

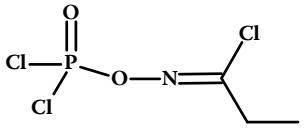
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



$C_3\ H_5\ Cl_3\ N\ O_2\ P$

Specific information is not available for this material. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

This material is a precursor for the oxime-series agents.

Exposure Hazards

Conversion Factor: 1 ppm = 9.18 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 224.4	*VP:* 0.04 mmHg (77°F) (est.)	*FlP:* —
D: —	*VD:* 7.7	*LEL:* —
MP: —	*Vlt:* —	*UEL:* —
BP: 153°F (2 mmHg)	*H_2O:* Sparingly soluble	*RP:* —
Vsc: —	*Sol:* —	*IP:* —

C01-C125

2-Chloro-N-[(chloromethoxyphosphinyl)oxy]ethanimidoyl Chloride

CAS: 114700-91-3

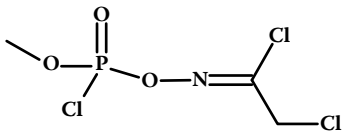
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



$C_3\ H_5\ Cl_3\ N\ O_3\ P$

Specific information is not available for this material. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

This material is a precursor for the oxime-series agents.

Exposure Hazards

Conversion Factor: 1 ppm = 9.83 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 240.4	*VP:* 0.03 mmHg (77°F) (est.)	*FlP:* —
D: —	*VD:* 8.3	*LEL:* —

MP: —	*Vlt:* —	*UEL*: —
BP: 244°F (2 mmHg)	*H_2O:* Sparingly soluble	*RP:* —
Vsc: —	*Sol:* —	*IP:* —

C01-C126

[(Chloroethoxyphosphinyl)oxy]carbonimidic Difluoride

CAS: 18262-31-2

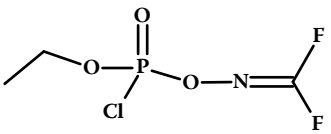
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



C_3 H_5 Cl F_2 N O_3 P

Specific information is not available for this material. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

This material is a precursor for the oxime-series agents.

Exposure Hazards

Conversion Factor: 1 ppm = 8.49 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 207.5	*VP:* 0.8 mmHg (77°F) (est.)	*FlP:* —
D: 1.4 g/mL	*VD:* 7.2	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 149°F (2 mmHg)	*H_2O:* Sparingly soluble	*RP:* —
Vsc: —	*Sol:* —	*IP:* —

C01-C127

N-[(Chloroethoxyphosphinyl)oxy]-2,2-difluoro-2-nitroethanimidoyl Fluoride

CAS: 18262-34-5

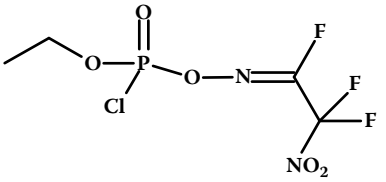
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



$C_4\ H_5\ Cl\ F_3\ N_2\ O_5\ P$

Specific information is not available for this material. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

This material is a precursor for the oxime-series agents.

Exposure Hazards

Conversion Factor: 1 ppm = 11.64 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 284.5	*VP:* 0.05 mmHg (77°F) (est.)	*FlP:* —
D: 1.5 g/mL	*VD:* 9.8	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 163°F (0.1 mmHg)	*H_2O:* Sparingly soluble	*RP:* —
Vsc: —	*Sol:* —	*IP:* —

C01-C128

2,2-Dichloro-N-[(chloroethoxyphosphinyl)oxy]ethanimidoyl Chloride

CAS: 114700-93-5

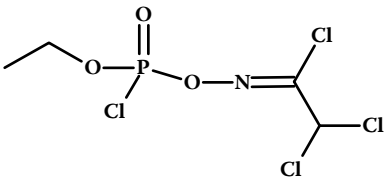
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



$C_4\ H_6\ Cl_4\ N\ O_3\ P$

Specific information is not available for this material. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

This material is a precursor for the oxime-series agents.

Exposure Hazards

Conversion Factor: 1 ppm = 11.82 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 288.9	*VP:* 0.006 mmHg (77°F) (est.)	*FlP:* —
D: —	*VD:* 10	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 234°F (1.5 mmHg)	*H_2O:* Sparingly soluble	*RP:* —
Vsc: —	*Sol:* —	*IP:* —

C01-C129

[[Chloroisopropylphosphinyl]oxy]carbonimidic Chloride Fluoride

CAS: 18262-28-7

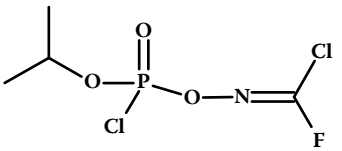
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



$C_4\ H_7\ Cl_2\ F\ N\ O_3\ P$

Specific information is not available for this material. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

This material is a precursor for the oxime-series agents.

Exposure Hazards

Conversion Factor: 1 ppm = 9.73 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 238.0	*VP:* 0.09 mmHg (77°F) (est.)	*FlP:* —
D: 1.4 g/mL	*VD:* 8.2	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 147°F (2 mmHg)	*H_2O:* Sparingly soluble	*RP:* —
Vsc: —	*Sol:* —	*IP:* —

C01-C130

[[Chloropropylphosphinyl]oxy]carbonimidic Chloride Fluoride

CAS: 18262-29-8

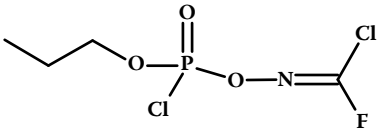
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



$C_4\ H_7\ Cl_2\ F\ N\ O_3\ P$

Specific information is not available for this material. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

This material is a precursor for the oxime-series agents.

Exposure Hazards

Conversion Factor: 1 ppm = 9.73 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 238.0	*VP:* 0.06 mmHg (77°F) (est.)	*FlP:* —
D: 1.3 g/mL	*VD:* 8.2	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 212°F (10 mmHg)	*H_2O:* Sparingly soluble	*RP:* —
Vsc: —	*Sol:* —	*IP:* —

C01-C131

N-[(Dichlorophosphinyl)oxy]-2-methylpropanimidoyl Chloride

CAS: 121951-56-2

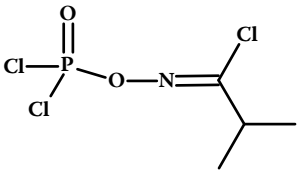
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



$C_4\ H_7\ Cl_3\ N\ O_2\ P$

Specific information is not available for this material. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

This material is a precursor for the oxime-series agents.

Exposure Hazards

Conversion Factor: 1 ppm = 9.75 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 238.4	*VP:* 0.02 mmHg (77°F) (est.)	*FlP:* —
D: —	*VD:* 8.2	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 154°F (2 mmHg)	H_2O: Sparingly soluble	*RP:* —
Vsc: —	*Sol:* —	*IP:* —

C01-C132

N-[(Dichlorophosphinyl)oxy]butanimidoyl Chloride

CAS: 121951-55-1

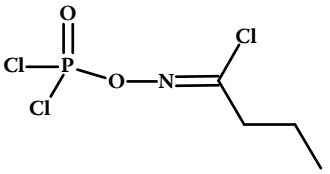
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



$C_4\ H_7\ Cl_3\ N\ O_2\ P$

Specific information is not available for this material. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

This material is a precursor for the oxime-series agents.

Exposure Hazards

Conversion Factor: 1 ppm = 9.75 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 238.4	*VP:* 0.02 mmHg (77°F) (est.)	*FlP:* —
D: —	*VD:* 8.2	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 180°F (3 mmHg)	H_2O: Sparingly soluble	*RP:* —
Vsc: —	*Sol:* —	*IP:* —

C01-C133

[[Chloroisopropylphosphinyl]oxy]carbonimidic Dichloride

CAS: 17642-34-1

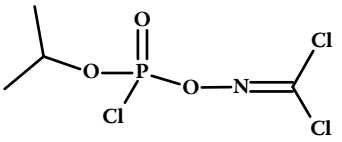
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



$C_4\ H_7\ Cl_3\ N\ O_3\ P$

Specific information is not available for this material. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

This material is a precursor for the oxime-series agents.

Exposure Hazards

Conversion Factor: 1 ppm = 10.40 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 254.4	*VP:* 0.02 mmHg (77°F) (est.)	*FlP:* —
D: 1.40 g/mL	*VD:* 8.8	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 194°F (2 mmHg)	*H_2O:* Sparingly soluble	*RP:* —
Vsc: —	*Sol:* —	*IP:* —

C01-C134

2-Chloro-N-[(chloroethoxyphosphinyl)oxy]ethanimidoyl Chloride

CAS: 114700-92-4

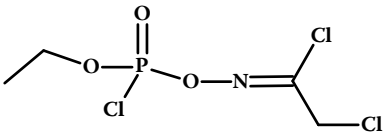
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



C_4 H7 Cl_3 N O_3 P

Specific information is not available for this material. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

This material is a precursor for the oxime-series agents.

Exposure Hazards

Conversion Factor: 1 ppm = 10.40 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 254.4	*VP:* 0.01 mmHg (77°F) (est.)	*FlP:* —
D: —	*VD:* 8.8	*LEL:* —
MP: —	*Vlt:* —	*UEL:* —
BP: 253°F (1.5 mmHg)	H_2O: Sparingly soluble	*RP:* —
Vsc: —	*Sol:* —	*IP:* —

C01-C135

[(Chloropropoxyphosphinyl)oxy]carbonimidic Dichloride

CAS: 37990-97-9

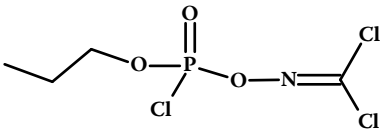
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



$C_4\ H_7\ Cl_3\ N\ O_3\ P$

Specific information is not available for this material. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

This material is a precursor for the oxime-series agents.

Exposure Hazards

Conversion Factor: 1 ppm = 10.40 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 254.4	*VP:* 0.01 mmHg (77°F) (est.)	*FlP:* —
D: —	*VD:* 8.8	*LEL:* —
MP: —	*Vlt:* —	*UEL:* —
BP: —	H_2O: Sparingly soluble	*RP:* —
Vsc: —	*Sol:* —	*IP:* —

C01-C136

[(Chloropropoxyphosphinyl)oxy]carbonimidic Difluoride

CAS: 37990-84-4

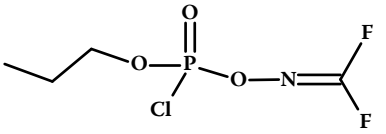
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



$C_4\ H_7\ Cl\ F_2\ N\ O_3\ P$

Specific information is not available for this material. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

This material is a precursor for the oxime-series agents.

Exposure Hazards

Conversion Factor: 1 ppm = 9.06 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 221.5	*VP:* 0.3 mmHg (77°F) (est.)	*FlP:* —
D: —	*VD:* 7.6	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: —	*H_2O:* Sparingly soluble	*RP:* —
Vsc: —	*Sol:* —	*IP:* —

C01-C137

[(Chloroisopropoxyphosphinyl)oxy]carbonimidic Difluoride

CAS: 18262-32-3

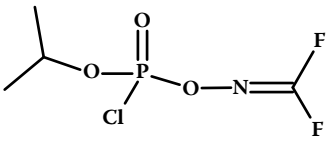
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



$C_4\ H_7\ Cl\ F_2\ N\ O_3\ P$

Specific information is not available for this material. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

This material is a precursor for the oxime-series agents.

Exposure Hazards

Conversion Factor: 1 ppm = 9.06 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

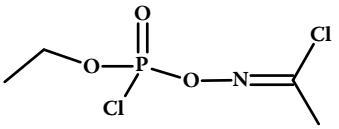
MW: 221.5	*VP:* 0.4 mmHg (77°F) (est.)	*FlP:* —
D: 1.4 g/mL	*VD:* 7.6	*LEL:* —

MP: —	*Vlt:* —	*UEL*: —
BP: 142°F (2 mmHg)	*H_2O:* Sparingly soluble	*RP:* —
Vsc: —	*Sol:* —	*IP:* —

C01-C138

N-[(Chloroethoxyphosphinyl)oxy]ethanimidoyl Chloride

CAS: 114700-90-2
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_4\ H_8\ Cl_2\ N\ O_3\ P$

Specific information is not available for this material. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

This material is a precursor for the oxime-series agents.

Exposure Hazards

Conversion Factor: 1 ppm = 9.00 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

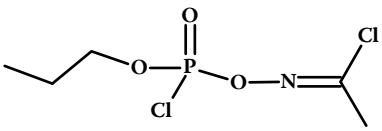
Properties:

MW: 220.0	*VP:* 0.08 mmHg (77°F) (est.)	*FlP:* —
D: —	*VD:* 7.6	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 205°F (3 mmHg)	*H_2O:* Sparingly soluble	*RP:* —
Vsc: —	*Sol:* —	*IP:* —

C01-C139

N-[(Chloropropoxyphosphinyl)oxy]ethanimidoyl Chloride

CAS: 129003-90-3
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_5\ H_{10}\ Cl_2\ N\ O_3\ P$

Specific information is not available for this material. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

This material is a precursor for the oxime-series agents.

Exposure Hazards

Conversion Factor: 1 ppm = 9.57 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 234.0	*VP:* 0.03 mmHg (77°F) (est.)	*FlP:* —
D: —	*VD:* 8.1	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 221°F (2 mmHg)	*H_2O:* Sparingly soluble	*RP:* —
Vsc: —	*Sol:* —	*IP:* —

C01-C140

N-[[Chloro(1-methylethoxy)phosphinyl]oxy]ethanimidoyl Chloride

CAS: 128981-16-8

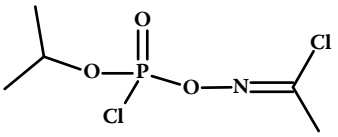
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



$C_5\ H_{10}\ Cl_2\ N\ O_3\ P$

Specific information is not available for this material. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

This material is a precursor for the oxime-series agents.

Exposure Hazards

Conversion Factor: 1 ppm = 9.57 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 234.0	*VP:* 0.04 mmHg (77°F) (est.)	*FlP:* —
D: —	*VD:* 8.1	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 210°F (2 mmHg)	*H_2O:* Sparingly soluble	*RP:* —
Vsc: —	*Sol:* —	*IP:* —

C01-C141

N-[(Chloroethoxyphosphinyl)oxy]propanimidoyl Chloride

CAS: 128981-18-0

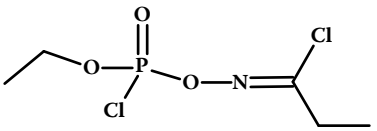
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



$C_5\ H_{10}\ Cl_2\ N\ O_3\ P$

Specific information is not available for this material. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

This material is a precursor for the oxime-series agents.

Exposure Hazards

Conversion Factor: 1 ppm = 9.57 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 234.0	*VP:* 0.03 mmHg (77°F) (est.)	*FlP:* —
D: —	*VD:* 8.1	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 219°F (2.5 mmHg)	*H_2O:* Sparingly soluble	*RP:* —
Vsc: —	*Sol:* —	*IP:* —

C01-C142

2-Chloro-N-[[chloro(2,2,3,3-tetrafluoropropoxy)phosphinyl]oxy]ethanimidoyl Chloride

CAS: 114967-39-4

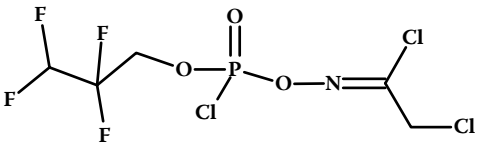
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



$C_5\ H_5\ Cl_3\ F_4\ N\ O_3\ P$

Specific information is not available for this material. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

This material is a precursor for the oxime-series agents.

Exposure Hazards

Conversion Factor: 1 ppm = 13.92 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 340.4	*VP:* 0.003 mmHg (77°F) (est.)	*FlP:* —
D: —	*VD:* 12	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 244°F (3 mmHg)	*H_2O:* Sparingly soluble	*RP:* —
Vsc: —	*Sol:* —	*IP:* —

C01-C143

[[2-Chloro-1-methylpropylphosphinyl]oxy]carbonimidic Chloride Fluoride

CAS: 24946-19-8

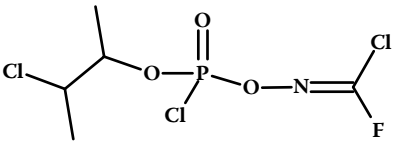
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



C_5 H_8 Cl_3 F N O_3 P

Specific information is not available for this material. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

This material is a precursor for the oxime-series agents.

Exposure Hazards

Conversion Factor: 1 ppm = 11.72 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

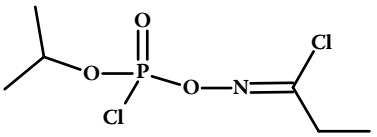
Properties:

MW: 286.5	*VP:* 0.004 mmHg (77°F) (est.)	*FlP:* —
D: 1.5 g/mL	*VD:* 9.9	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 183°F (0.3 mmHg)	*H_2O:* Sparingly soluble	*RP:* —
Vsc: —	*Sol:* —	*IP:* —

C01-C144

N-[[Chloro(1-methylethoxy)phosphinyl]oxy]propanimidoyl Chloride

CAS: 128981-20-4
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_6\ H_{12}\ Cl_2\ N\ O_3\ P$

Specific information is not available for this material. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

This material is a precursor for the oxime-series agents.

Exposure Hazards

Conversion Factor: 1 ppm = 10.14 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

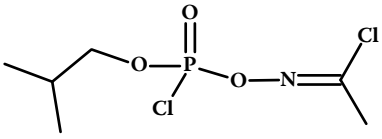
Properties:

MW: 248.0	*VP:* 0.02 mmHg (77°F) (est.)	*FlP:* —
D: —	*VD:* 8.6	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 207°F (2 mmHg)	*H_2O:* Sparingly soluble	*RP:* —
Vsc: —	*Sol:* —	*IP:* —

C01-C145

N-[[Chloro(2-methylpropoxy)phosphinyl]oxy]ethanimidoyl Chloride

CAS: 128981-17-9
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_6\ H_{12}\ Cl_2\ N\ O_3\ P$

Specific information is not available for this material. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

This material is a precursor for the oxime-series agents.

Exposure Hazards

Conversion Factor: 1 ppm = 10.14 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 248.0	*VP:* 0.02 mmHg (77°F) (est.)	*FlP:* —
D: —	*VD:* 8.6	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 226°F (2 mmHg)	*H_2O:* Sparingly soluble	*RP:* —
Vsc: —	*Sol:* —	*IP:* —

C01-C146

N-[(Chloropropoxyphosphinyl)oxy]propanimidoyl Chloride

CAS: 128981-19-1

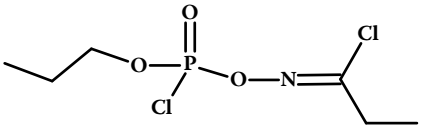
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



$C_6\ H_{12}\ Cl_2\ N\ O_3\ P$

Specific information is not available for this material. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

This material is a precursor for the oxime-series agents.

Exposure Hazards

Conversion Factor: 1 ppm = 10.14 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

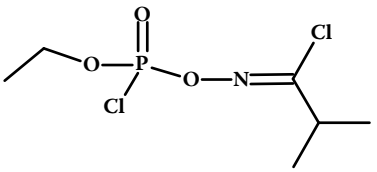
Properties:

MW: 248.0	*VP:* 0.01 mmHg (77°F) (est.)	*FlP:* —
D: —	*VD:* 8.6	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 216°F (2 mmHg)	*H_2O:* Sparingly soluble	*RP:* —
Vsc: —	*Sol:* —	*IP:* —

C01-C147

N-[(Chloroethoxyphosphinyl)oxy]-2-methylpropanimidoyl Chloride

CAS: 128981-25-9
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_6 H_{12} Cl_2 N O_3 P$

Specific information is not available for this material. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

This material is a precursor for the oxime-series agents.

Exposure Hazards

Conversion Factor: 1 ppm = 10.14 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

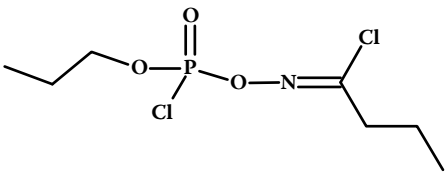
Properties:

MW: 248.0	*VP:* 0.02 mmHg (77°F) (est.)	*FlP:* —
D: —	*VD:* 8.6	*LEL:* —
MP: —	*Vlt:* —	*UEL:* —
BP: 207°F (2 mmHg)	*H_2O:* Sparingly soluble	*RP:* —
Vsc: —	*Sol:* —	*IP:* —

C01-C148

N-[(Chloropropoxyphosphinyl)oxy]butanimidoyl Chloride

CAS: 128981-22-6
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_7 H_{14} Cl_2 N O_3 P$

Specific information is not available for this material. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

This material is a precursor for the oxime-series agents.

Exposure Hazards

Conversion Factor: 1 ppm = 10.72 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 262.1	*VP:* 0.004 mmHg (77°F) (est.)	*FlP:* —
D: —	*VD:* 9.0	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 226°F (2 mmHg)	*H_2O:* Sparingly soluble	*RP:* —
Vsc: —	*Sol:* —	*IP:* —

C01-C149

N-[[Chloro(2-methylpropoxy)phosphinyl]oxy]propanimidoyl Chloride

CAS: 128981-21-5

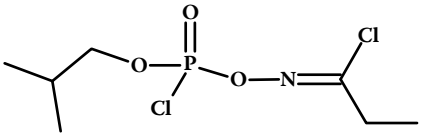
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



C_7 H_{14} Cl_2 N O_3 P

Specific information is not available for this material. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

This material is a precursor for the oxime-series agents.

Exposure Hazards

Conversion Factor: 1 ppm = 10.72 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 262.1	*VP:* 0.006 mmHg (77°F) (est.)	*FlP:* —
D: —	*VD:* 9.0	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 228°F (2 mmHg)	*H_2O:* Sparingly soluble	*RP:* —
Vsc: —	*Sol:* —	*IP:* —

C01-C150

N-[[Chloro(1-methylethoxy)phosphinyl]oxy]butanimidoyl Chloride

CAS: 128981-23-7

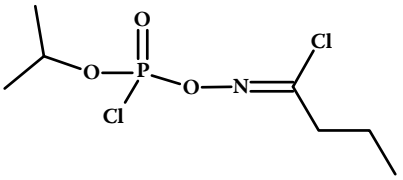
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



$C_7\ H_{14}\ Cl_2\ N\ O_3\ P$

Specific information is not available for this material. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

This material is a precursor for the oxime-series agents.

Exposure Hazards

Conversion Factor: 1 ppm = 10.72 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 262.1	*VP:* 0.006 mmHg (77°F) (est.)	*FlP:* —
D: —	*VD:* 9.0	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 221°F (2 mmHg)	*H_2O:* Sparingly soluble	*RP:* —
Vsc: —	*Sol:* —	*IP:* —

C01-C151

N-[[Chloro(1-methylethoxy)phosphinyl]oxy]-2-methylpropanimidoyl Chloride

CAS: 128981-27-1

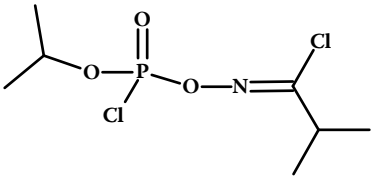
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



$C_7\ H_{14}\ Cl_2\ N\ O_3\ P$

Specific information is not available for this material. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

This material is a precursor for the oxime-series agents.

Exposure Hazards

Conversion Factor: 1 ppm = 10.72 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 262.1	*VP:* 0.008 mmHg (77°F) (est.)	*FlP:* —
D: —	*VD:* 9.0	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 214°F (2 mmHg)	*H_2O:* Sparingly soluble	*RP:* —
Vsc: —	*Sol:* —	*IP:* —

C01-C152

N-[(Chloropropoxyphosphinyl)oxy]-2-methylpropanimidoyl Chloride

CAS: 128981-26-0

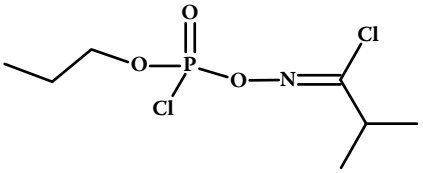
RTECS: —

UN: —

EC: —

UNII: —

ICD-11:



C_7 H_{14} Cl_2 N O_3 P

Specific information is not available for this material. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

This material is a precursor for the oxime-series agents.

Exposure Hazards

Conversion Factor: 1 ppm = 10.72 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

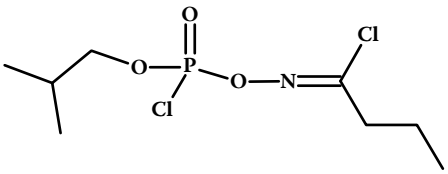
Properties:

MW: 262.1	*VP:* 0.006 mmHg (77°F) (est.)	*FlP:* —
D: —	*VD:* 9.0	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 225°F (2 mmHg)	*H_2O:* Sparingly soluble	*RP:* —
Vsc: —	*Sol:* —	*IP:* —

C01-C153

N-[[Chloro(2-methylpropoxy)phosphinyl]oxy]butanimidoyl Chloride

CAS: 128981-24-8
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_8\ H_{16}\ Cl_2\ N\ O_3\ P$

Specific information is not available for this material. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.
This material is a precursor for the oxime-series agents.

Exposure Hazards

Conversion Factor: 1 ppm = 11.29 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

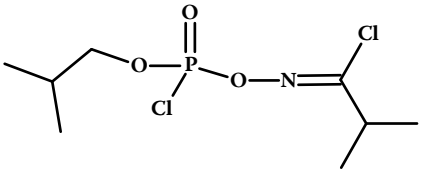
Properties:

MW: 276.1	*VP:* 0.002 mmHg (77°F) (est.)	*FlP:* —
D: —	*VD:* 9.5	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 226°F (1.5 mmHg)	*H_2O:* Sparingly soluble	*RP:* —
Vsc: —	*Sol:* —	*IP:* —

C01-C154

N-[[Chloro(2-methylpropoxy)phosphinyl]oxy]-2-methylpropanimidoyl Chloride

CAS: 128981-28-2
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_8\ H_{16}\ Cl_2\ N\ O_3\ P$

Specific information is not available for this material. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

This material is a precursor for the oxime-series agents.

Exposure Hazards

Conversion Factor: 1 ppm = 11.29 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

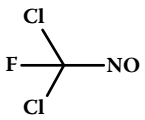
Properties:

MW: 276.1	*VP:* 0.003 mmHg (77°F) (est.)	*FlP:* —
D: —	*VD:* 9.5	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 228°F (2 mmHg)	*H_2O:* Sparingly soluble	*RP:* —
Vsc: —	*Sol:* —	*IP:* —

C01-C155

Dichlorofluoronitrosomethane

CAS: 1495-28-9
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



C Cl_2 F N O

Specific information is not available for this material.

Exposure Hazards

Conversion Factor: 1 ppm = 5.39 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

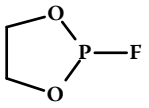
MW: 131.9	*VP:* 646 mmHg (77°F)	*FlP:* 47°F (est.)
D: 1.7 g/mL	*VD:* 4.6	*LEL:* —
MP: –19°F (est.)	*Vlt:* 850,000 ppm	*UEL*: —
BP: 85°F	*ER:* 310	*RP:* 0.014
Vsc: —	*H_2O:* —	*IP:* 10.58 eV
	Sol: —	

C01-C156

Ethylene Fluorophosphite

CAS: 765-40-2

RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



C_2 H_4 F O_2 P

Liquid. Other information is not available for this material.

Exposure Hazards

Conversion Factor: 1 ppm = 4.50 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

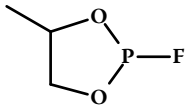
Properties:

MW: 110.0	*VP:* 100 mmHg (est.)	*FlP:* 65°F (est.)
D: —	*VD:* 3.8	*LEL:* —
MP: –50°F (est.)	*Vlt:* —	*UEL*: —
BP: 118°F (170 mmHg)	*ER:* —	*RP:* —
Vsc: —	*H_2O:* —	*IP:* —
	Sol: —	

C01-C157

Propylene Fluorophosphite

CAS: 16415-09-1
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



C3 H6 F O2 P

Liquid with a disagreeable odor.

Exposure Hazards

Conversion Factor: 1 ppm = 5.08 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

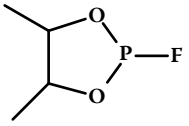
MW: 124.1	*VP:* —	*FlP:* —
D: 1.2 g/mL	*VD:* 4.3	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —

BP: 111°F (100 mmHg)	*ER:* —	*RP:* —
Vsc: —	*H_2O:* —	*IP:* —
	Sol: —	

C01-C158

2,3-Butylene Fluorophosphite

CAS: 19952-57-9
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



C_4 H_8 F O_2 P

Liquid. Other information is not available for this material.

Exposure Hazards

Conversion Factor: 1 ppm = 5.65 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

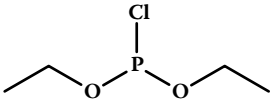
MW: 138.1	*VP:* —	*FlP:* —
D: 1.2 g/mL	*VD:* 4.8	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 82°F (16 mmHg)	*ER:* —	*RP:* —
Vsc: —	*H_2O:* —	*IP:* —
	Sol: —	

C01-C159

Diethyl Chlorophosphite

CAS: 589-57-1
RTECS: —
UN: —
EC: 209-652-2
UNII: F414S3V8K6

ICD-11: —



C_4 H_{10} Cl O_2 P

Colorless to pale yellow liquid with an acrid odor. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts.

Causes severe skin and eye burns with respiratory irritation.

This material is on the Australia Group Control list.

This material is a precursor for novichok nerve agents.

Exposure Hazards

Conversion Factor: 1 ppm = 6.40 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

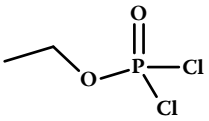
Properties:

MW: 156.6	*VP:* 4.2 mmHg	*FlP:* 34°F
D: 1.1 gm/mL	*VD:* 5.4	*LEL:* —
MP: —	*Vlt:* 5,600 ppm	*UEL*: —
BP: 309°F	*ER:* —	*RP:* —
Vsc: —	*H_2O:* Reacts	*IP:* 9.50 eV
	Sol: Chloroform, DMSO	

C01-C160

Ethyl Dichlorophosphate

CAS: 1498-51-7
RTECS: TD4390000
UN:
EC: 216-099-0
UNII: 4IP5DTW75U
ICD-11:



C_2 H_5 Cl_2 O_2 P

Colorless to light brown liquid with a pungent odor. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts.

Causes severe skin and eye burns with respiratory irritation.

This material is on the Australia Group Control list.

This material is a precursor for novichok nerve agents.

Exposure Hazards

Conversion Factor: 1 ppm = 6.66 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: —; Mar: 0.60 ppm; Crit: 6.0 ppm; Cat: —
PAC-1: 0.018 ppm; *PAC-2:* 0.20 ppm; *PAC-3:* 0.60 ppm

Properties:

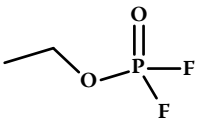
MW: 162.9	*VP:* —	*FlP:* 235°F
D: 1.4 gm/mL (77°F)	*VD:* 5.6	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —

BP: 333°F	*ER:* —	*RP:* —
Vsc: —	*H_2O:* Reacts	*IP:* 11.42 eV
	Sol: —	

C01-C161

Ethyl Difluorophosphate

CAS: 460-52-6
RTECS: TD4480000
UN:
EC: —
UNII: —
ICD-11: —



C_2 H_5 F_2 O_2 P

Liquid. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts.

This material is on the Australia Group Control list.

This material is a precursor for novichok nerve agents.

Exposure Hazards

Conversion Factor: 1 ppm = 5.32 mg/m^3 at 77°F
PAC-1: 4.9 ppm; *PAC-2:* 53 ppm; *PAC-3:* 320 ppm

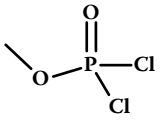
Properties:

MW: 130.0	*VP:* 66.2 (77°F)	*FlP:* 46°F
D: 1.3 gm/mL	*VD:* 4.5	*LEL:* —
MP: —	*Vlt:* 87,000 ppm (77°F)	*UEL*: —
BP: 193°F	*ER:* —	*RP:* 0.13
Vsc: —	*H_2O:* Reacts	*IP:* —
	Sol: —	

C01-C162

Methyl Dichlorophosphate

CAS: 677-24-7
RTECS: —
UN:
EC: 211-639-1
UNII: —
ICD-11: —



$C H_3 Cl_2 O_2 P$

Colorless to pale yellow liquid. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts.

Causes severe skin and eye burns with respiratory irritation.

This material is on the Australia Group Control list.

This material is a precursor for novichok nerve agents.

Exposure Hazards

Conversion Factor: 1 ppm = 6.09 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 148.9	*VP:* —	*FlP:* 235°F
D: 1.5 gm/mL	*VD:* 5.1	*LEL:* —
MP: –51°F	*Vlt:* —	*UEL*: —
BP: 145°F (15 mmHg)	*ER:* —	*RP:* —
Vsc: —	*H_2O:* Reacts	*IP:* 11.50 eV
	Sol: —	

C01-C163

N,N-Dimethylaminophosphoryl Dichloride

CAS: 677-43-0

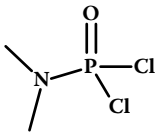
RTECS: BT2275000

UN: —

EC: 217-592-3

UNII: —

ICD-11: —



$C_2 H_6 Cl_2 N O P$

Colorless to pale yellow liquid. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts.

Causes severe skin and eye burns with respiratory irritation.

This material is on Schedule 2 of the CWC, the Australia Group Core list, and DHS Chemicals of Interest list.

This material is a precursor for G-series nerve agents.

Exposure Hazards

Conversion Factor: 1 ppm = 6.63 mg/m^3 at 77°F

Other human toxicity values have not been established or have not been published.

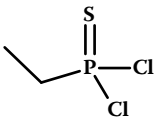
Properties:

MW: 162.0	*VP:* —	*FlP:* 132°F
D: 1.4 g/mL	*VD:* 5.6	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 383°F	*ER:* —	*RP:* —
Vsc: —	*H_2O:* Reacts	*IP:* 9.31 eV
	Sol: Dimethoxyethane	

C01-C164

Ethyl Phosphonothioic Dichloride

CAS: 993-43-1
RTECS: —
UN: —
EC: 213-609-3
UNII: —
ICD-11: —



C_5 H_5 Cl_2 P S

Clear colorless liquid with a pungent odor. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts.

This material is on Schedule 2 of the CWC, DHS Chemicals of Interest list and the ITF-25 Low Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 6.67 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

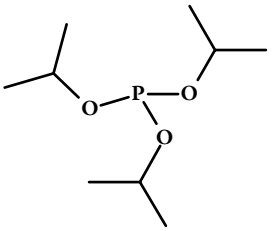
MW: 163.0	*VP:* 1.45 mmHg (70°F)	*FlP:* 203°F
D: 1.4 gm/mL	*VD:* 5.6	*LEL:* —
MP: —	*Vlt:* 1,900 ppm	*UEL*: —
BP: 342°F	*ER:* —	*RP:* 5.4
Vsc: —	*H_2O:* Reacts	*IP:* —
	Sol: —	

C01-C165

Triisopropylphosphite

CAS: 116-17-6
RTECS: TH2800000

UN: —
EC: 204-130-0
UNII: RJ7QU4YQUN
ICD-11: —



$C_9\ H_{21}\ O_3\ P$

Colorless liquid. This material is hazardous through ingestion, and produces local skin/eye impacts.

Causes skin irritation.

This material is on the Australia Group Core list.

Exposure Hazards

Conversion Factor: 1 ppm = 8.52 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

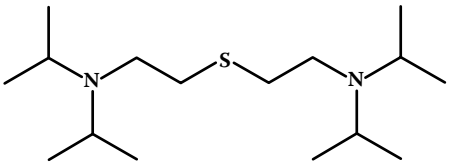
Properties:

MW: 208.2	*VP:* 1.95 mmHg	*FlP:* 165°F
D: 0.84 gm/mL	*VD:* 7.2	*LEL:* —
MP: —	*Vlt:* 2,600 ppm	*UEL*: —
BP: 165°F (20 mmHg)	*ER:* —	*RP:* 3.5
Vsc: —	*H_2O:* Insoluble	*IP:* 8.76 eV
	Sol: Alcohol, ether, chloroform	

C01-D DECOMPOSITION PRODUCTS AND IMPURITIES

C01-D166

Bis(2-diisopropylaminoethyl)sulfide ([DE2]S)
CAS: 110501-56-9
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_{16}\ H_{36}\ N_2\ S$

Specific information is not available for this material.

This material is a degradation product from hydrolysis of V-series nerve agents.

Exposure Hazards

Conversion Factor: 1 ppm = 11.80 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 288.5	*VP:* 2.7×10^{-7} mmHg	*FlP:* —
D: —	*VD:* 10	*LEL:* —
MP: -22 (est.)	*Vlt:* —	*UEL:* —
BP: 563 (est.)	*ER:* —	*RP:* —
Vsc: —	*H_2O:* 1×10^{-4} %	*IP:* —
	Sol: —	

C01-D167

Bis[2-(diisopropylamino)ethyl] Disulfide (Agent EA 4196)

CAS: 65332-44-7

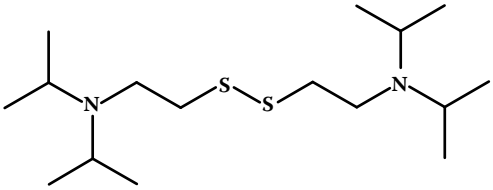
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



$C_{16}\ H_{36}\ N_2\ S_2$

Specific information is not available for this material

This material is a degradation product from hydrolysis of V-series nerve agents.

Exposure Hazards

Conversion Factor: 1 ppm = 13.11 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 320.6	*VP:* 5.9×10^{-9} mmHg	*FlP:* 354°F
D: 0.95 g/cm^3	*VD:* 11	*LEL:* —

MP: 110°F (est.)	*Vlt:* —	*UEL:* —
BP: 702°F	*ER:* —	*RP:* —
Vsc: —	*H_2O:* 0.001%	*IP:* —
	Sol: —	

C01-D168

Ethyl Methylphosphonic Acid (EMPA)

CAS: 1832-53-7; 6838-91-1 (Sodium salt); 81280-64-0 (Ammonium salt)

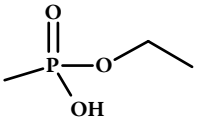
RTECS: —

UN: —

EC: —

UNII: 921S33S5Y5

ICD-11: —



C_3 H_9 O_3 P

Liquid. Other information is not available for this material. Various salts (solids) have been reported.

This material is on Schedule 2 of the CWC.

This material is a degradation product from hydrolysis of VX (C01-A017) and Ethyl Sarin (C01-A004).

Exposure Hazards

Conversion Factor: 1 ppm = 5.08 mg/m^3 at 77°F

PAC-1: 10 mg/m^3; *PAC-2:* 110 mg/m^3; *PAC-3:* 1,600 mg/m^3

Properties:

MW: 124.1	*VP:* 3.6×10^{-4} mmHg	*FlP:* 235°F
D: 1.2 g/mL	*VD:* 4.3	*LEL:* —
MP: 85°F (est.)	*Vlt:* —	*UEL:* —
BP: 226°F (0.4 mmHg)	*ER:* —	*RP:* —
Vsc: —	*H_2O:* 18%	*IP:* —
	Sol: —	

C01-D169

O,S-Diethyl Methylphosphonothioate (Agent EA 5533)

CAS: 2511-10-6

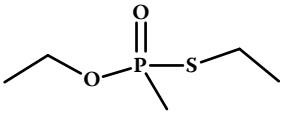
RTECS: TB1085000

UN: —

EC: —

UNII: —

ICD-11: —



$C_5 H_{13} O_2 P S$

Liquid. Other information is not available for this material.

This material is on Schedule 2 of the CWC.

This material is commonly found as an impurity and degradation product from hydrolysis of VX (C01-A017). This material has been used as a simulant in government tests.

Exposure Hazards

Conversion Factor: 1 ppm = 6.88 mg/m^3 at 77°F

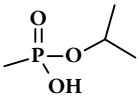
Human toxicity values have not been established or have not been published.

Properties:

MW: 168.2	*VP:* 0.081mmHg (77°F)	*FlP:* 175°F
D: 1.1 g/mL	*VD:* 5.8	*LEL:* —
MP: 17°F	*Vlt:* 100 ppm (77°F)	*UEL:* —
BP: 445°F	*ER:* —	*RP:* 96
Vsc: —	*H_2O:* 1.6%	*IP:* —
	Sol: —	

C01-D170

Isopropyl Methylphosphonic Acid (IMPA)
CAS: 1832-54-8; 6838-93-3 (Sodium salt)
RTECS: —
UN: —
EC: —
UNII: 30DEK38OFS
ICD-11: —



$C_4 H_{11} O_3 P$

Colorless, hygroscopic oil.

This material is on Schedule 2 of the CWC.

It is commonly found as an impurity and degradation product from hydrolysis of sarin (C01-A002) as well as a metabolite resulting from exposure. It can be converted back into sarin by fluorination.

Exposure Hazards

Conversion Factor: 1 ppm = 5.65 mg/m^3 at 77°F

PAC-1: 21 mg/m^3; *PAC-2:* 230 mg/m^3; *PAC-3:* 1,400 mg/m^3

Properties:

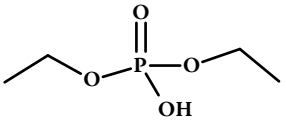
MW: 138.1	*VP:* 0.012 mmHg (77°F) (est.)	*FlP:* 156°F
D: 1.1 g/mL	*VD:* 4.8	*LEL:* —

MP: 64°F (est.)	*Vlt:* —	*UEL*: —
BP: 208°F	*ER:* —	*RP:* —
Vsc: —	*H_2O:* 12% (est.)	*IP:* —
	Sol: —	

C01-D171

N,N′-Dicyclohexylurea

CAS: 2387-23-7
RTECS: —
UN: —
EC: 219-213-7
UNII: ZV7823VVIM
ICD-11: —



C_{13} H_{24} N_2 O

White crystalline powder.

This material is commonly found as a degradation product from hydrolysis of VX stabilizer Dicyclohexylcarbodiimide (C01-C056).

Exposure Hazards

Conversion Factor: 1 ppm = 9.17 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

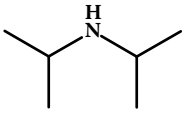
Properties:

MW: 224.3	*VP:* —	*FlP:* —
D: 1.3 g/cm^3	*VD:* —	*LEL:* —
MP: 448°F	*Vlt:* —	*UEL*: —
BP: —	*ER:* —	*RP:* —
Vsc: —	*H_2O:* —	*IP:* —
	Sol: —	

C01-D172

N-Chloroisopropylamine

CAS: 26245-56-7
RTECS: —
UN: —
EC: 247-535-8
UNII: VY3E772E6A
ICD-11: —



C_3 H_8 Cl N

Specific information is not available for this material.

This material is a degradation product from the reaction of VX (C01-A017) with hypochlorites.

Exposure Hazards

Conversion Factor: 1 ppm = 3.83 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 93.6	*VP:* 130 mmHg (77°F)	*FlP:* —
D: 0.95 g/mL	*VD:* 3.2	*LEL:* —
MP: —	*Vlt:* 170,000 ppm (77°F)	*UEL:* —
BP: 158°F	*ER:* 240	*RP:* 0.08
Vsc: —	*H_2O:* —	*IP:* —
	Sol: —	

C01-D173

Diethyl Hydrogen Phosphate

CAS: 598-02-7

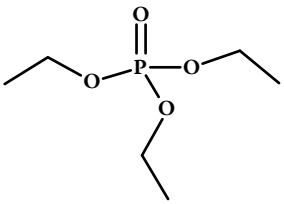
RTECS: TC0665000

UN: —

EC: 209-912-5

UNII: —

ICD-11: —



C_4 H_{11} O_4 P

Clear, colorless to light yellow-orange liquid.

This material is commonly found as a degradation product from hydrolysis of tabun (C01-A001) and the organophosphorus insecticide Chlorpyrifos, as well as a metabolite found in urine and used as a biomarker of exposure to these materials.

Exposure Hazards

Conversion Factor: 1 ppm = 6.30 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

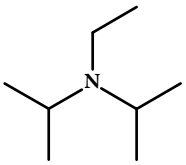
MW: 154.1	*VP:* —	*FlP:* 196°F
D: 1.3 g/mL	*VD:* 5.3	*LEL:* —

MP: 43°F	*Vlt:* —	*UEL*: —
BP: 397°F	*ER:* —	*RP:* —
Vsc: —	*H_2O:* Slight	*IP:* —
	Sol: —	

C01-D174

Diisopropylamine

CAS: 108-18-9; 819-79-4 (Hydrochloride salt); 65087-26-5 (Sulfate salt)
RTECS: IM4025000
UN: 1158; 132
EC: 203-558-5
UNII: BR9JLI40NO
ICD-11: XM0MW9



$C_6\ H_{15}\ N$

Colorless liquid with an odor like ammonia or fish. Various salts (solids) have been reported. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Concentrations between 25 ppm and 50 ppm can cause vision disturbances (e.g., colored haloes to be seen around lights).

Used industrially for organic synthesis; as an antifoam agent, as a stabilizer for mesityl oxide; and as a chemical intermediate for detergents; dyes; pesticides; and pharmaceuticals.

This material is on the Australia Group Export Control list.

This is commonly found as an impurity in VX (C01-A017) and from decomposition of VX with hypochlorite.

Exposure Hazards

Conversion Factor: 1 ppm = 4.14 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 9.7 ppm; Mar: 72 ppm; Crit: 180 ppm; Cat: —
PAC-1: 15 ppm; *PAC-2:* 160 ppm; *PAC-3:* 990 ppm
PEL: 5 ppm [Skin]
REL: 5 ppm [Skin]
TLV: 5 ppm [Skin]
IDLH: 200 ppm

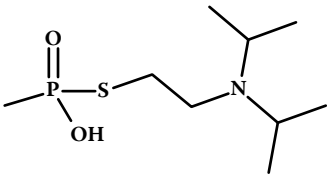
Properties:

MW: 101.2	*VP:* 70 mmHg	*FlP:* 30°F
D: 0.72 g/mL	*VD:* 3.5	*LEL:* 1.1%
MP: –78°F	*Vlt:* 100,000 ppm (77°F)	*UEL*: 7.1%
BP: 183°F	ER: 170	*RP:* 0.13
Vsc: 0.56 cs (77°F)	*H_2O:* Miscible	*IP:* 7.73 eV
	Sol: Acetone, benzene, ether, ethanol	

C01-D175

Triethyl Phosphate

CAS: 78-40-0
RTECS: TC7900000
UN: —
EC: 201-114-5
UNII: QIH4K96K7J
ICD-11: —



$C_6\ H_{15}\ O_4\ P$

Clear, colorless liquid with a mild odor. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts.

Used industrially as a chemical intermediate for organophosphorus insecticides, as a catalyst in the production of acetic anhydride by the ketene process; and used in industry as a plasticizer, fire-retarding agent, anti-foaming agent, and desensitizing agent for peroxides.

This material is commonly found a degradation product of Tabun (C01-A001). This material has been used as a simulant in government tests.

Exposure Hazards

Conversion Factor: 1 ppm = 7.45 mg/m^3 at 77°F
MEG$_{(1hr)}$: Neg: 27 ppm; Mar: —; Crit: 67 ppm; Cat: —
PAC-1: 3.1 ppm; *PAC-2:* 34 ppm; *PAC-3:* 43 ppm
WEEL: 1 ppm

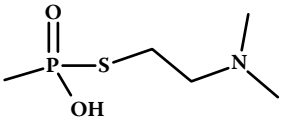
Properties:

MW: 182.2	*VP:* 0.39 mmHg (77°F)	*FlP:* 240°F
D: 1.1 g/mL	*VD:* 6.3	*LEL:* —
MP: –70°F	*Vlt:* 510 ppm (77°F)	*UEL:* —
BP: 419°F	*ER:* —	*RP:* 19
Vsc: —	*H_2O:* 50%	*IP:* 10.0 eV
	Sol: Most organic solvents	

C01-D176

N,N-Diisopropylethylamine

CAS: 7087-68-5
RTECS: —
UN: —
EC: 230-392-0
UNII: 5SIQ15721L
ICD-11: —



$C_8\ H_{19}\ N$

Clear colorless to yellow liquid with an amine odor. Various salts (solids) have been reported. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts.

Used as a reagent in organic chemistry.

This material is commonly found as an impurity and degradation product in VX (C01-A017).

Exposure Hazards

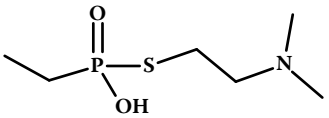
Conversion Factor: 1 ppm = 5.28 mg/m^3 at 77°F
MEC$_{(1hr)}$: Neg: 5.7 ppm; Mar: 38 ppm; Crit: 190 ppm; Cat: —
PAC-1: 1.8 ppm; *PAC-2:* 19 ppm; *PAC-3:* 120 ppm

Properties:

MW: 129.2	*VP:* 31 mmHg (100°F)	*FlP:* 43°F
D: 0.78 g/mL	*VD:* 4.5	*LEL:* 3%
MP: –51°F	*Vlt:* 39,000 ppm (100°F)	*UEL*: 17%
BP: 261°F	*ER:* —	*RP:* 0.30
Vsc: —	*H_2O:* Miscible	*IP:* —
	Sol: —	

C01-D177

Hydrogen S-2-Diisopropylaminoethyl Methylphosphonothiolate (Agent EA 2192)
CAS: 73207-98-4
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_9\ H_{22}\ N\ O_2\ P\ S$

White solid. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion.

This material is on Schedule 1 of the CWC.

This material is a degradation product from hydrolysis of VX (C01-A017), a V-series nerve agent.

Exposure Hazards

Conversion Factor: 1 ppm = 9.79 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published. However, based on available information, this material appears to have nearly the same toxicity as the parent compound.

Properties:

MW: 239.3	*VP:* —	*FlP:* 308°F
D: 1.1 g/mL	*VD:* 8.3	*LEL:* —
MP: —	*Vlt:* —	*UEL:* —
BP: 625°F	*ER:* —	*RP:* —
Vsc: —	*H_2O:* Miscible	*IP:* —
	Sol: —	

C01-D178

Hydrogen S-2-Dimethylaminoethyl Methylphosphonothiolate

CAS: 34256-71-8

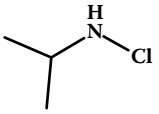
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



$C_5\ H_{14}\ N\ O_2\ P\ S$

This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion.

This material is on Schedule 1 of the CWC.

This material is a degradation product from hydrolysis of Vx (C01-A018), a V-series nerve agent.

Exposure Hazards

Conversion Factor: 1 ppm = 7.49 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published. However, based on available information, this material appears to have nearly the same toxicity as the parent compound.

Properties:

MW: 183.2	*VP:* —	*FlP:* —
D: —	*VD:* 6.3	*LEL:* —
MP: —	*Vlt:* —	*UEL:* —
BP: —	*ER:* —	*RP:* —
Vsc: —	*H_2O:* Soluble	*IP:* —
	Sol: —	

C01-D179

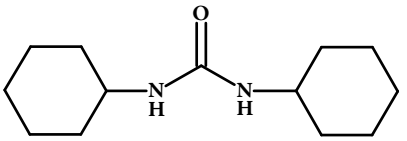
Hydrogen S-2-Dimethylaminoethyl Ethylphosphonothiolate

CAS: 1253735-44-2

RTECS: —

UN: —

EC: —
UNII: —
ICD-11: —



$C_6\ H_{16}\ N\ O_2\ P\ S$

This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion.

This material is on Schedule 1 of the CWC.

This material is a degradation product from hydrolysis of Ethyl S-[2-(dimethylamino)ethyl] ethylphosphonothiolate (C01-A023), a V-series nerve agent.

Exposure Hazards

Conversion Factor: 1 ppm = 8.07 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published. However, based on available information, this material appears to have nearly the same toxicity as the parent compound.

Properties:

MW: 197.2	*VP:* —	*FlP:* —
D: —	*VD:* 6.8	*LEL:* —
MP: —	*Vlt:* —	*UEL:* —
BP: —	*ER:* —	*RP:* —
Vsc: —	*H_2O:* Soluble	*IP:* —
	Sol: —	

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2 Carbamate Nerve Agents

GENERAL INFORMATION

This class of agents was added to the Chemical Weapons Convention on November 27, 2019. The agents in this class consist of quaternary and bisquaternary amines of methylcarbamoyloxypyridines. The dimethylcarbamoyloxypyridines are listed in Schedule 1 of the Chemical Weapons Convention as long as they are within the following limitations:

1-[N,N-Dialkyl(C≤10)-N-(n-(hydroxyl, cyano, acetoxy) alkyl(C≤10)) ammonio]-n-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dialkyl(C≤10) ammonio]decane dibromide (n=1-8)

OR

1,n-Bis[N-(3-dimethylcarbamoxy-α-picolyl)-N,N-dialkyl((C≤10) ammonio]-alkane-(2,(n-1)-dione) dibromide (n=2-12)

The quaternary amine centers increase the ability of the agent to penetrate into neuromuscular junctions. They are relatively simple to synthesize although the starting materials are not commonly available. Because they produce negligible vapor, they are somewhat difficult to deliver in a manner that will produce immediate casualties.

Although carbamates were investigated as warfare agents in the 1940s and 1950s, there is no information to indicate that these agents have ever been used other than for research purposes.

TOXICOLOGY

Effects

Nerve agents are the most toxic of formerly stockpiled man-made chemical warfare agents. These compounds are similar to, but much more deadly than, agricultural carbamate pesticides. Nerve agents disrupt the function of the nervous system by interfering with the enzyme acetylcholinesterase. Serious effects are on skeletal muscles and the central nervous system. Nerve agents also affect glands that discharges secretions to the outside of the body causing discharge of mucous, saliva, sweat, and gastrointestinal fluids. Exposure to solids, solutions, or aerosols from these agents is hazardous and can result in death within minutes of exposure.

Pathways and Routes of Exposure

Nerve agents are hazardous through any route of exposure including inhalation, exposure of the skin and eye, ingestion, and broken, abraded, or lacerated skin (e.g., penetration of skin by debris).

General Exposure Hazards

Carbamate nerve agents do not have good warning properties. They have no odor, and, other than causing miosis, aerosols do not irritate the eyes. Contact neither irritates the skin nor causes cutaneous injuries.

Human toxicity data for the carbamate nerve agents has not been published or has not been established.

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These agents are rapidly detoxified or eliminated from the body and there is little or no cumulative toxicity. Some agents are refractory to treatment.

Latency Period

Aerosols (mists or dusts)

Depending on the concentration of agent aerosols, the effects begin to appear 30 seconds to 2 minutes after initial exposure.

Solids/Solutions (non-aerosol)

Typically, there is a latent period with no visible effects between the time of exposure and the sudden onset of symptoms. This latency can range from 1minute to 18 hours and is affected by such factors as the amount of agent involved, the amount of skin surface in contact with the agent and previous exposure to materials that chap or dry the skin (e.g., organic solvents such gasoline or alcohols). Moist, sweaty areas of the body are more susceptible to percutaneous penetration by solid nerve agents.

Another key factor is the part of the body that is exposed to the agent. It takes more time for the agent to penetrate areas of the body that are covered by thicker and tougher skin. The regions of the body that allows the fastest percutaneous penetration are the groin, head, and neck. The least susceptible body regions are the hands, feet, front of the knee, and outside of the elbow.

CHARACTERISTICS

Physical Appearance/Odor

Laboratory Grade

Laboratory grade agents are typically white, to pale yellow crystalline solids. Some are hygroscopic or deliquescent. They have little or no odor.

Modified Agents

Carbamate nerve agents have been dissolved in both water and organic solvents to facilitate handling, enhance dispersal or to increase the ease of percutaneous penetration by the agents. Percutaneous enhancement solvents include dimethyl sulfoxide, N,N-dimethylformamide, N,N-dimethylpalmitamide, N,N-dimethyldecanamide, and saponin. Color and other properties of these solutions may vary from the pure agent. Odors will be dependent on the characteristics of the solvent(s) used.

Stability

Dry carbamate nerve agents are stable over a wide range of temperatures. Stabilizers are not required. Agents can be stored in glass, steel, stainless steel, or aluminum containers. Agents in solution are much more susceptible to hydrolysis and decomposition.

Persistency

For military purposes, unmodified carbamate nerve agents are classified as extremely persistent. Agents have negligible vapor pressure and they will not evaporate. Depending on the size of the individual particles and on any encapsulation or coatings applied to the particles, they can be re-aerosolized by ground traffic or strong winds.

Environmental Fate

Carbamate nerve agent are nonvolatile and do not pose a vapor hazard. Although these agents may be dissolved in volatile solvents, evaporation of the solvent does not increase the evaporation of the agent itself. Porous material, including painted surfaces, may absorb solutions of agents. After the initial surface contamination has been removed, agent that has been absorbed into porous material can migrate back to the surface posing a contact hazard.

Although these nerve agents are water soluble, agent solubility may be modified (either increased or decreased) by solvents. These agents are also soluble in some polar organic solvents such as alcohols and acetonitrile.

ADDITIONAL HAZARDS

Exposure

Individuals who have had previous exposure to materials that chap or dry the skin, such as alcohols, gasoline, or paint thinners, may be more susceptible to percutaneous exposure from dermal contact with these agents. In these situations, the rate of percutaneous penetration of the agent is greatly increased resulting in a decrease in the survival time that would otherwise be expected.

All foodstuffs in the area of a release should be considered contaminated. Unopened items packaged in glass, metal or heavy-duty plastic and exposed only to agent aerosols may be used after decontamination of the container. Unopened items exposed to solid agents or solutions of agents should be decontaminated within a few hours post exposure or destroyed. Opened or unpackaged items, or those packaged only in paper or cardboard, should be destroyed.

Meat from animals that have suffered only mild to moderate effects from exposure to nerve agents should be safe to consume. Milk should be discarded for the first 7 days post exposure and then should be safe to consume. Meat, milk and animal products, including hides, from animals severely affected or killed by nerve agents should be destroyed.

Plants, fruits, vegetables, and grains exposed to carbamate nerve agents should be quarantined until tested.

Livestock/Pets

Animals can be decontaminated with shampoo/soap and water (see the decontamination section below). If the animal's eyes have been exposed to agent, they should be irrigated with water or saline solution for a minimum of 30 minutes.

The topmost layer of unprotected feedstock (e.g., hay or grain) should be destroyed. The remaining material should be quarantined until tested. Carbamate nerve agents are very persistent and forage vegetation could still retain sufficient agent to produce severe effects for several weeks post release, depending on the level of contamination and the weather conditions.

Fire

Heat from a fire will destroy carbamate nerve agents before generating any significant concentration of agent vapor. However, it is possible that hot gases from the fire may distill some of the agent and create a hazardous aerosol within the smoke. Actions taken to extinguish the fire can spread the agent. Carbamates are water soluble and runoff from firefighting efforts will pose a significant threat. Some of the potential decomposition products include toxic and/or corrosive gases.

Reactivity

Carbamate nerve agents are stable in water. However, at high pH they are rapidly destroyed.

Hazardous Decomposition Products

Hydrolysis

Agents produce methylamine (CH_3NH_2) or dimethylamine ($(CH_3)_2NH$), carbon dioxide (CO_2), and complex organic compounds.

Combustion

Volatile decomposition products may include hydrogen chloride (HCl), hydrogen bromide (HBr), hydrogen iodide (HI), carbon dioxide (CO_2), aromatic hydrocarbons, and nitrogen oxides (NO_x).

PROTECTION

Evacuation Recommendations

There are no published recommendations for isolation or protective action distances for carbamate nerve agents released in mass casualty situations.

Personal Protective Requirements

Structural Firefighters' Gear

Structural firefighters' protective clothing is recommended for fire situations only; it is not effective in spill situations or release events. However, since carbamate nerve agents have negligible vapor pressure, they do not pose a vapor hazard. The primary risk of exposure is through contact with aerosolized agents, solids, or solutions of agents. If chemical protective clothing is not available and it is necessary to rescue casualties from a contaminated area, then structural firefighters' gear will provide some skin protection against nerve agent aerosols. Contact with solids and solutions should be avoided.

Even though carbamate nerve agents are rapidly detoxified or eliminated from the body, exposures may have a cumulative effect in the short term, placing all responders who entered the hot zone without appropriate chemical protective clothing at increased risk during the remainder of the emergency.

Respiratory Protection

Self-contained breathing apparatuses (SCBAs) or air purifying respirators (APRs) should have a National Institute for Occupational Safety and Health (NIOSH) Chemical/Biological/Radiological/Nuclear (CBRN) certification. However, during emergency operations, other NIOSH-approved SCBAs or APRs that have been specifically tested by the manufacturer against chemical warfare agents may be used if deemed necessary by the incident commander. APRs should be equipped with a NIOSH-approved CBRN filter or a combination organic vapor/acid gas/particulate cartridge.

Immediately dangerous to life or health (IDLH) levels are the ceiling limit for respirators other than SCBAs. However, IDLH levels have not been established for carbamate nerve agents. Therefore, any potential exposure to aerosols of these agents should be regarded with extreme caution and the use of SCBAs for respiratory protection should be considered.

Chemical Protective Clothing

Currently, there is no information on performance testing of chemical protective clothing against carbamate nerve agents. Evaluation of fabrics used to prevent exposure to carbamate pesticides may provide guidance on selection of appropriate protective clothing.

Because these agents do not produce any significant concentration of vapor, the primary risk of exposure is through inhalation of aerosols or by the percutaneous migration of agent following

dermal exposure to solid agents or solutions containing these agents. However, aerosolized agents can also penetrate the skin and produce a toxic effect. If there is any possibility of contact with aerosolized agent, then responders should consider wearing a Level A protective ensemble.

Decontamination

General

Carbamate nerve agents are readily destroyed by high pH (i.e., basic solutions). Use an aqueous caustic solution (minimum of 10% by weight sodium hydroxide or sodium carbonate) or use undiluted household bleach. Basic peroxides, including Sandia decontamination foam formulations, also rapidly detoxify carbamate nerve agents.

Solutions or Liquid Aerosols

Casualties/Personnel

Cover all open wounds during the decontamination process. Remove all clothing immediately. To avoid further exposure of the head, neck, and face to the agent, cut off potentially contaminated clothing that must be pulled over the head. Remove as much of the nerve agent from the skin as fast as possible. If water is not immediately available, the agent can be absorbed with any convenient material such as paper towels, toilet paper, flour, or talc. To minimize both spreading the agent and abrading the skin, do not rub the agent with the absorbent. Blot the contaminated skin with the absorbent.

Use a sponge or cloth with liquid soap and copious amounts of water to wash the skin surface and hair at least three times. Ideally, showers will be high volume with low pressure. Do not delay decontamination to find warm or hot water if it is not readily available. Avoid rough scrubbing as this could abrade the skin and increase percutaneous absorption of residual agent. Rinse with copious amounts of water. If there is a potential that the eyes have been exposed to nerve agents, irrigate with water or 0.9% saline solution for a minimum of 15 minutes.

Small areas

Ventilate to remove the aerosol. Puddles of liquid can be contained by covering with absorbent material such as vermiculite, diatomaceous earth, clay, sponges, or towels. Place the absorbed material into containers lined with high-density polyethylene. Before sealing the container, cover the contents with an aqueous caustic solution or undiluted household bleach (see general section above). Wash the area with copious amounts of the soap and water. Collect and containerize the rinseate. Removal of porous material, including painted surfaces, may be required because nerve agent that has been absorbed into these materials can migrate back to the surface and pose a contact hazard.

Solids or Particulate Aerosols

Casualties/Personnel

Cover all open wounds during the decontamination process. Do not attempt to brush the agent off the individual or their clothing as this can aerosolized the agent. If possible, dampen the agent with a water mist to help prevent aerosolization. Remove all clothing immediately. To avoid further exposure of the head, neck, and face to the agent, cut off potentially contaminated clothing that must be pulled over the head. Wash the skin surface and hair at least three times with copious amounts of soap and water. Ideally, showers will be high volume with low pressure. Do not delay decontamination to find warm or hot water if it is not readily available. Rinse with copious amounts of water. If there is a potential that the eyes have been exposed to nerve agents, irrigate with water or 0.9% saline solution for a minimum of 15 minutes.

Small areas

If indoors, close windows and doors in the area and turn off anything that could create air currents (e.g., fans, air conditioner, etc.). Allow aerosol to settle. Avoid actions that could aerosolize the agent such as sweeping or brushing. Collected the agent using a vacuum cleaner equipped with a high-efficiency particulate air (HEPA) filter. Do not use a standard home or industrial vacuum. Do not allow the vacuum exhaust to stir the air in the affected area. Vacuum all surfaces with extreme care in a very slow and controlled manner to minimize aerosolizing the agent. Place the collected material into containers lined with high-density polyethylene. Before sealing the container, cover the contents with an aqueous caustic solution or undiluted household bleach (see general section above). Wash the area with copious amounts of the soap and water. Collect and containerize the rinseate.

MEDICAL

CDC Case Definition

The CDC has not published a specific case definition for intoxication by carbamates.

Differential Diagnosis

The following factors have been suggested as alternatives to consider when presented with a potential case of exposure to nerve agents: carbamate and organophosphate pesticides; alkaloids such as nicotine or coniine; ingestion of mushrooms containing muscarine; and medicinals such as carbamates, cholinomimetic compounds, and neuromuscular blocking drugs.

Signs and Symptoms

Aerosols

Pin-pointing of pupils (miosis) and extreme nasal discharge (rhinorrhea) may be the first indications of exposure. The casualty may also experience difficulty breathing with a feeling of shortness of breath or tightness of the chest. In cases of exposure to high aerosol concentrations, the gastrointestinal tract may be affected resulting in vomiting, urination, or defecation. Inhalation of lethal amounts of nerve agent can cause loss of consciousness and convulsions in as little as 30 seconds, followed by cessation of breathing and flaccid paralysis after several more minutes.

Solutions/Solids

Localized sweating, nausea, vomiting, involuntary urination/defecation, and a feeling of weakness are signs of small to moderate nerve agent exposure. Miosis usually does not occur unless the individual has had agent in or around their eyes. Exposure to a large amount of agent cause copious secretions, loss of consciousness, convulsions progressing into flaccid paralysis, and cessation of breathing.

Mass-Casualty Triage Recommendations

Priority 1

A casualty with symptoms in two or more organ systems (not including miosis or rhinorrhea), who has a heartbeat and a palpable blood pressure. The casualty may or may not be conscious and/or breathing.

Priority 2

A casualty with a known exposed to a solid agent or solution but no apparent signs or symptoms, a casualty who is recovering from a severe exposure after receiving treatment.

Priority 3

A casualty who is walking and talking, although miosis and/or rhinorrhea may be present.

Priority 4

A casualty who is not breathing and does not have a heartbeat or palpable blood pressure.

Casualty Management

Decontaminate the casualty ensuring that all nerve agent has been removed. If nerve agents have gotten into the eyes, irrigate the eyes with water or 0.9% saline solution for at least 15 minutes. Irrigate open wounds with water or 0.9% saline solution for at least 10 minutes. However, do not delay treatment if thorough decontamination cannot be undertaken immediately.

Although these agents do not produce any significant vapor, aerosolization of residual dusts on casualties could cause impacts to medical responders. Once the casualty has been decontaminated, including the removal of foreign matter from wounds, medical personnel do not need to wear a chemical-protective mask.

Ventilate the patient. There may be an increase in airway resistance due to constriction of the airway and the presence of secretions. If breathing is difficult, administer oxygen. As soon as possible administer atropine. Severely poisoned individuals may exhibit tolerance to atropine and require large doses. Oximes such as pralidoxime chloride (2-PAM Cl) do not significantly increase the effectiveness of atropine and in some cases may be contraindicated. Diazepam may be required to prevent and/or control severe convulsions. If diazepam is not administered within 40 minutes post exposure, then its effectiveness at controlling seizures is minimal. These agents are rapidly detoxified or eliminated from the body and aging of these agents is not an issue.

FATALITY MANAGEMENT

Remove all clothing and personal effects segregating them as either durable or non-durable items. While it may be possible to decontaminate durable items, it may be safer and more efficient to destroy non-durable items rather than attempt to decontaminate them. Items that will be retained for further processing should be double sealed in impermeable containers, ensuring that the inner container is decontaminated before placing it in the outer one.

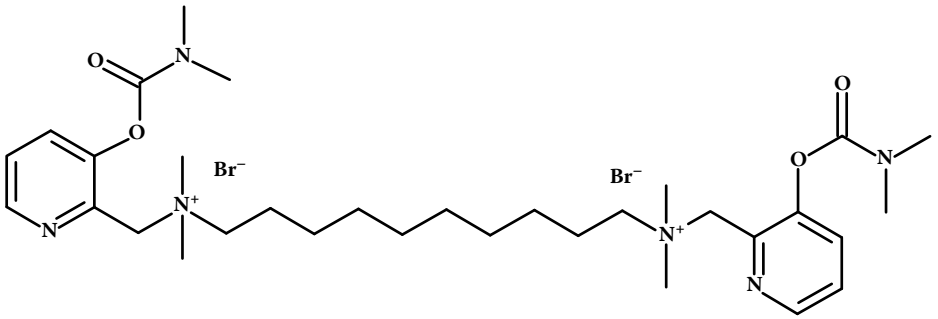
Carbamate nerve agents that have entered the body are metabolized, hydrolyzed or bound to tissue and pose little threat of off-gassing. To remove agents on the outside of the body, wear appropriate respiratory and dermal protective clothing while washing the remains with copious amounts of soap and water, ensuring the solution is introduced into the ears, nostrils, mouth, and any wounds. Pay particular attention to areas where agent may get trapped, such as hair, scalp, pubic areas, fingernails, folds of skin, and wounds. All wash and rinse waste must be contained for proper disposal. Body fluids removed during the embalming process do not pose any additional risks and should be contained and handled according to established procedures.

Once the remains have been thoroughly decontaminated, no further protective action is necessary. Use standard burial procedures.

C02-A AGENTS

C02-A001

1,10-Bis[methyl-2-(3-dimethyl-carbamoxypyridyl)methylamino]decane Dimethobromide
(Agent EA 3887)
CAS: 110913-97-8
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_{32}\ H_{54}\ N_6\ O_4 \cdot Br_2$

White odorless solid. Various other salts have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards

This agent is refractory to treatment.

Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be approximately twice as toxic as VX (C01-A017). The iodine salt is slightly more toxic than VX.

Properties:

MW: 746.7	*VP:* Negligible	*FlP:* —
D: 1.4 g/cm^3	*VD:* —	*LEL:* —
MP: Decomposes	*Vlt:* —	*UEL:* —
BP: —	*H_2O:* Soluble	*RP:* Extremely persistent
Vsc: —	*Sol:* Alcohols; acetonitrile	*IP:* —

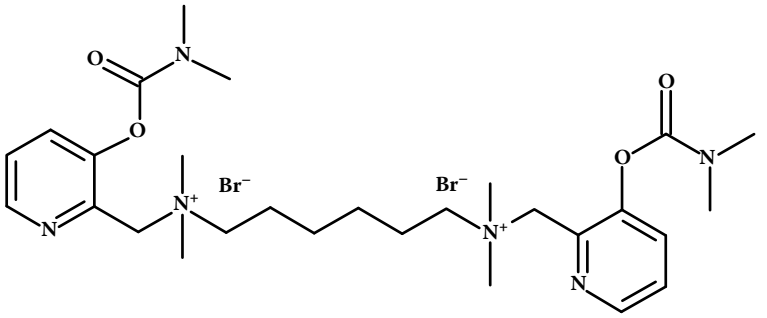
Iodide Salt

MW: 840.6
MP: 320°F

C02-A002

1,6-Bis[methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]hexane Dimethobromide
(Agent EA 3948)
CAS: 110913-93-4
RTECS: —

UN: —
EC: —
UNII: —
ICD-11: —



$C_{28}\ H_{46}\ N_6\ O_4 \cdot Br_2$

Crystalline solid. Various other salts have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be approximately half as toxic as VX (C01-A017).

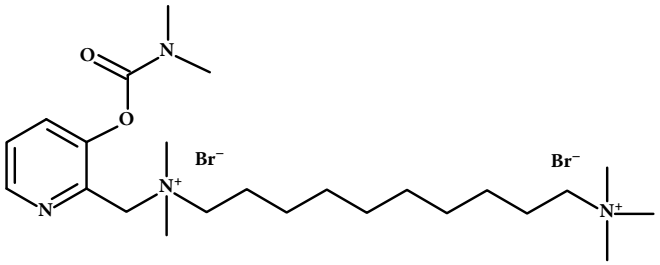
Properties:

MW: 690.5	*VP:* Negligible	*FlP:* —
D: —	*VD:* —	*LEL:* —
MP: 293°–297°F	*Vlt:* —	*UEL:* —
BP: —	*H_2O:* Soluble	*RP:* Persistent
Vsc: —	*Sol:* Alcohols	*IP:* —

C02-A003

1-(N,N-Dimethylamino)-10-[N-(3-dimethylcarbamoxy-2-pyridylmethyl)-N-methylamino] decane Dimethobromide (Agent EA 3966)

CAS: 110913-86-5
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_{24}\ H_{46}\ N_4\ O_2 \cdot Br_2$

Crystalline solid. Various other salts have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards

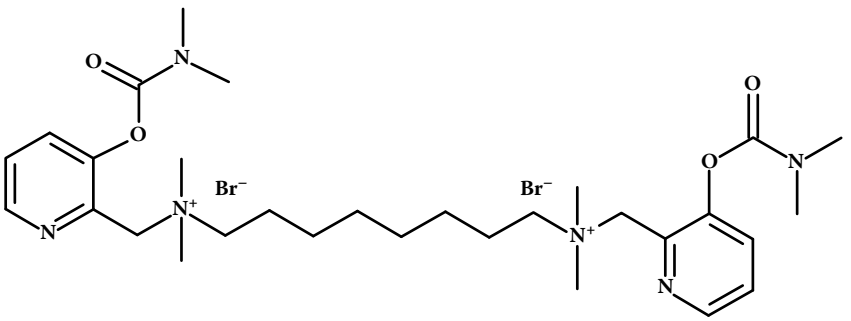
Human toxicity values have not been established or have not been published.

Properties:

MW: 582.5	*VP:* Negligible	*FlP:* —
D: —	*VD:* —	*LEL:* —
MP: Decomposes	*Vlt:* —	*UEL*: —
BP: —	*H_2O:* Soluble	*RP:* Persistent
Vsc: —	*Sol:* Acetonitrile	*IP:* —

C02-A004

1,8-Bis[methyl-2(3-dimethylcarbamoxypyridyl)methylamino]octane Dimethobromide
(Agent EA 3990)
CAS: 110913-95-6
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_{30}\ H_{50}\ N_6\ O_4 \cdot Br_2$

White, odorless crystalline solid. Various other salts have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards

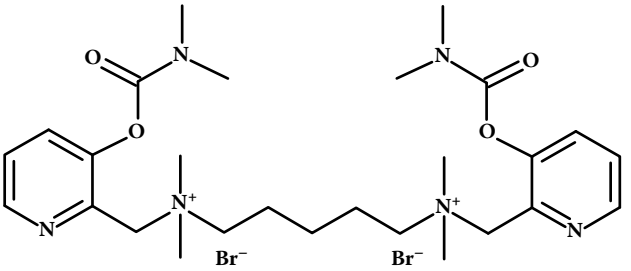
Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be approximately three times more toxic than VX (C01-A017).

Properties:

MW: 718.7	*VP:* Negligible	*FlP:* —
D: 1.3 g/cm^3	*VD:* —	*LEL:* —
MP: Decomposes	*Vlt:* —	*UEL*: —
BP: —	*H_2O:* 82% (77°F)	*RP:* Extremely persistent
Vsc: —	*Sol:* Alcohols; acetic acid; chloroform	*IP:* —

C02-A005

1,5-Bis[methyl-2(3-dimethylcarbamoxypyridyl)methylamino]pentane Dimethobromide
(Agent EA 4026)
CAS: 110913-92-3
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_{27}H_{44}N_6O_4 \cdot Br_2$

Crystalline solid. Various other salts have been reported.

This material is on Schedule 1 of the CWC.

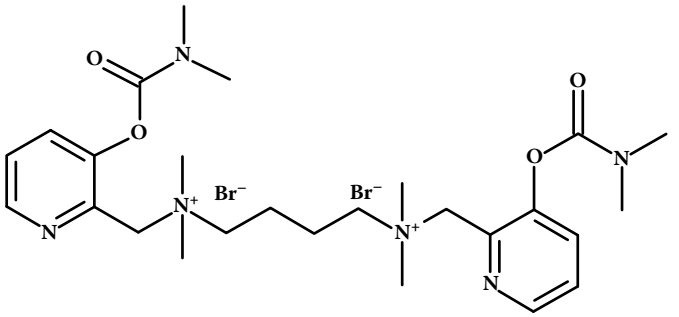
Exposure Hazards
Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be approximately one-fifth as toxic as VX (C01-A017).

Properties:

MW: 676.5	*VP:* Negligible	*FlP:* —
D: —	*VD:* —	*LEL:* —
MP: 370°–381°F	*Vlt:* —	*UEL*: —
BP: —	*H_2O:* Soluble	*RP:* Persistent
Vsc: —	*Sol:* Alcohols	*IP:* —

C02-A006

1,4-Bis[methyl-2(3-dimethylcarbamoxypyridyl)methylamino]butane Dimethobromide
(Agent EA 4038)
CAS: 110913-91-2
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_{26}\ H_{42}\ N_6\ O_4 \cdot Br_2$

Crystalline solid. Various other salts have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards

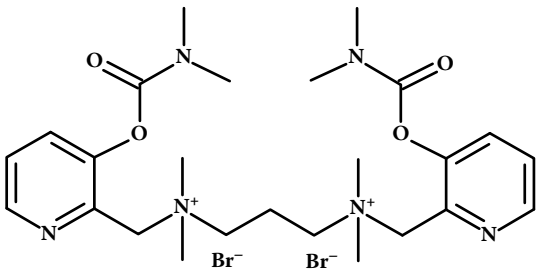
Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be approximately 200 times less toxic than VX (C01-A017).

Properties:

MW: 662.5	*VP:* Negligible	*FlP:* —
D: —	*VD:* —	*LEL:* —
MP: 338°–347°F	*Vlt:* —	*UEL*: —
BP: —	*H_2O:* Soluble	*RP:* Persistent
Vsc: —	*Sol:* Alcohols	*IP:* —

C02-A007

1,3-Bis[methyl-2(3-dimethylcarbamoxypyridyl)methylamino]propane Dimethobromide
(Agent EA 4048)
CAS: 110913-90-1
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_{25}\ H_{40}\ N_6\ O_4 \cdot Br_2$

Crystalline solid. Various other salts have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards

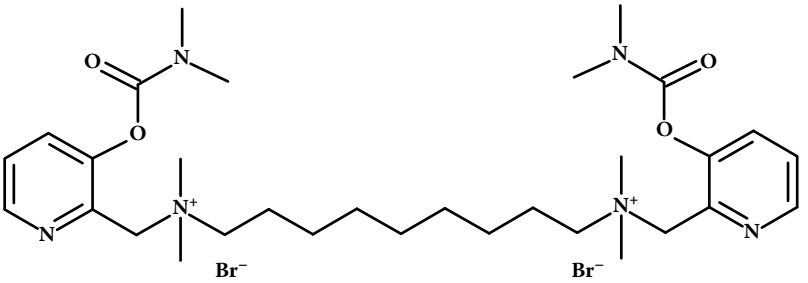
Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to have minimal toxicity.

Properties:

MW: 648.4	*VP:* Negligible	*FlP:* —
D: —	*VD:* —	*LEL:* —
MP: 388°F	*Vlt:* —	*UEL*: —
BP: —	*H_2O:* Soluble	*RP:* Persistent
Vsc: —	*Sol:* —	*IP:* —

C02-A008

1,9-Bis[methyl-2(3-dimethylcarbamoxypyridyl)methylamino]nonane Dimethobromide
(Agent EA 4056)
CAS: 110913-96-7
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_{31}\ H_{52}\ N_6\ O_4 \cdot Br_2$

Crystalline solid. Various other salts have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards

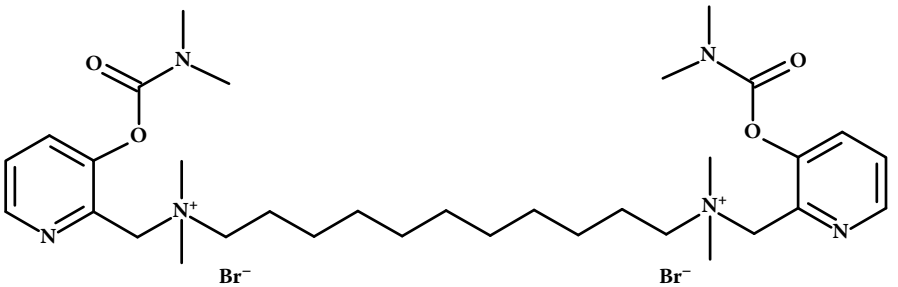
Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be approximately three times more toxic than VX (C01-A017).

Properties:

MW: 732.6	*VP:* Negligible	*FlP:* —
D: —	*VD:* —	*LEL:* —
MP: 212°–221°F	*Vlt:* —	*UEL*: —
BP: —	*H_2O:* Soluble	*RP:* Persistent
Vsc: —	*Sol:* Alcohols	*IP:* —

C02-A009

1,11-Bis[methyl-2(3-dimethylcarbamoxypyridyl)methylamino]undecane Dimethobromide
(Agent EA 4057)
CAS: 110913-98-9
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_{33}\ H_{56}\ N_6\ O_4 \cdot Br_2$

Crystalline solid. Various other salts have been reported.

This material is on Schedule 1 of the CWC.

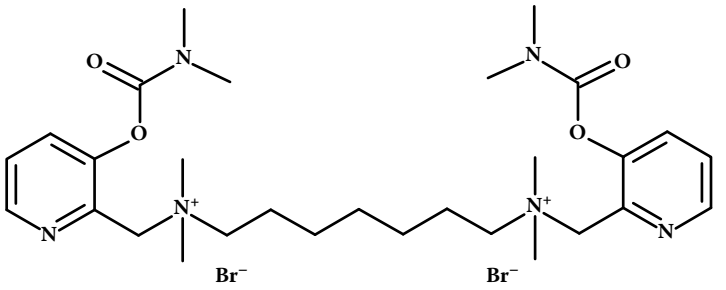
Exposure Hazards
Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be slightly more toxic than VX (C01-A017).

Properties:

MW: 760.7	*VP:* Negligible	*FlP:* —
D: —	*VD:* —	*LEL:* —
MP: 266°–270°F	*Vlt:* —	*UEL*: —
BP: —	*H_2O:* Soluble	*RP:* Persistent
Vsc: —	*Sol:* Alcohols	*IP:* —

C02-A010

1,7-Bis[methyl-2(3-dimethylcarbamoxypyridyl)methylamino]heptane Dimethobromide
(Agent EA 4181)
CAS: 110913-94-5
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_{29}\ H_{48}\ N_6\ O_4 \cdot Br_2$

Crystalline solid. Various other salts have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be slightly more toxic than VX (C01-A017).

Properties:

MW: 704.5	*VP:* Negligible	*FlP:* —
D: —	*VD:* —	*LEL:* —
MP: 320°–325°F	*Vlt:* —	*UEL*: —
BP: —	*H_2O:* Soluble	*RP:* Persistent
Vsc: —	*Sol:* Alcohols	*IP:* —

C02-A011

1-(4-Dimethylaminophenoxy)-2-(3-dimethylamino-5-dimethylcarbamoxyphenoxy)ethane Dimethiodide

CAS: 57169-76-3

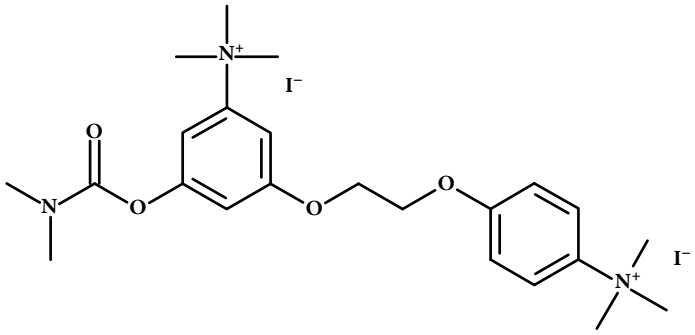
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



$C_{23}\ H_{35}\ N_3\ O_4 \cdot I_2$

Pale yellow crystalline solid. Various other salts have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be just as toxic as VX (C01-A017).

Properties:

MW: 671.4	*VP:* Negligible	*FlP:* —
D: —	*VD:* —	*LEL:* —
MP: 266°F	*Vlt:* —	*UEL*: —
BP: —	*H_2O:* —	*RP:* Persistent
Vsc: —	*Sol:* —	*IP:* —

C02-A012

1-(3-Dimethylaminophenoxy)-3-(3-dimethylamino-5-dimethylcarbamoxyphenoxy)propane Dimethiodide

CAS: 57168-28-2

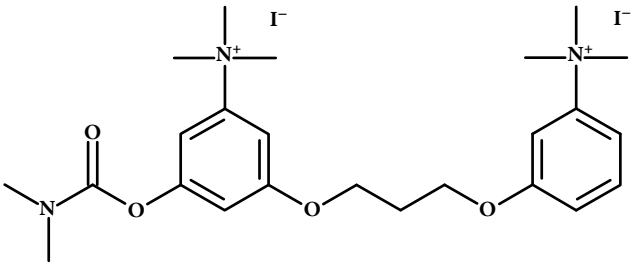
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



C_{24} H_{37} N_3 O4 · I_2

Crystalline solid. Various other salts have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be just as toxic as VX (C01-A017).

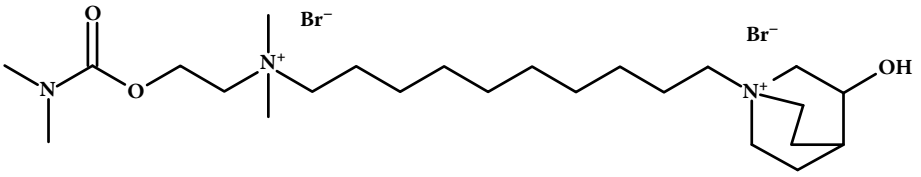
Properties:

MW: 685.4	*VP:* Negligible	*FlP:* —
D: —	*VD:* —	*LEL:* —
MP: 360°F	*Vlt:* —	*UEL*: —
BP: —	*H_2O:* Soluble	*RP:* Persistent
Vsc: —	*Sol:* —	*IP:* —

C02-A013

Decamethylene-(3-hydroxyquinuclidinium Bromide) [(2-Dimethylcarbamoxy-ethyl) dimethylammonium Bromide]

CAS: 58619-61-7
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_{24}\ H_{49}\ N_3\ O_3 \cdot Br_2$

Specific information on physical appearance is not available for this agent. Various other salts have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be approximately 50 times less toxic than VX (C01-A017).

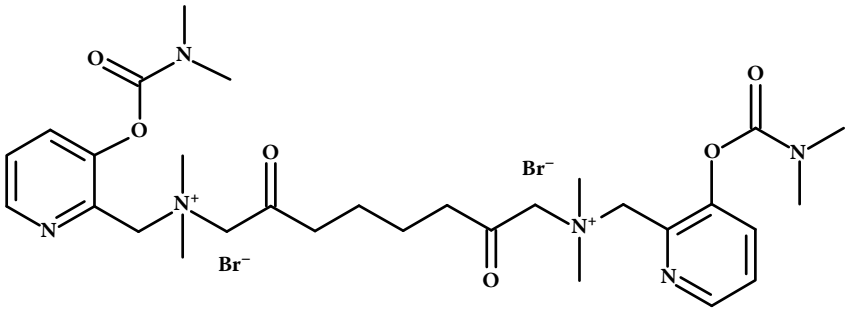
Properties:

MW: 587.5	*VP:* Negligible	*FlP:* —
D: —	*VD:* —	*LEL:* —
MP: 286°F	*Vlt:* —	*UEL*: —
BP: —	*H_2O:* Soluble	*RP:* Persistent
Vsc: —	*Sol:* Alcohols	*IP:* —

C02-A014

1,8-Bis[N-(3-dimethylcarbamoxy-α-picolyl)-N,N-dimethylammonio]octane-2,7-dione Dibromide

CAS: 77104-01-9
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_{30}\ H_{46}\ N_6\ O_6 \cdot Br_2$

Crystalline solid. Various other salts have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be approximately three times more toxic than VX (C01-A017).

Properties:

MW: 746.5	*VP:* Negligible	*FlP:* —
D: —	*VD:* —	*LEL:* —
MP: 410°F	*Vlt:* —	*UEL*: —
BP: —	*H_2O:* Soluble	*RP:* Persistent
Vsc: —	*Sol:* Alcohols	*IP:* —

C02-A015

Octamethylene-bis(5-dimethylcarbamoxyisoquinolinium Bromide)

CAS: 110203-40-2

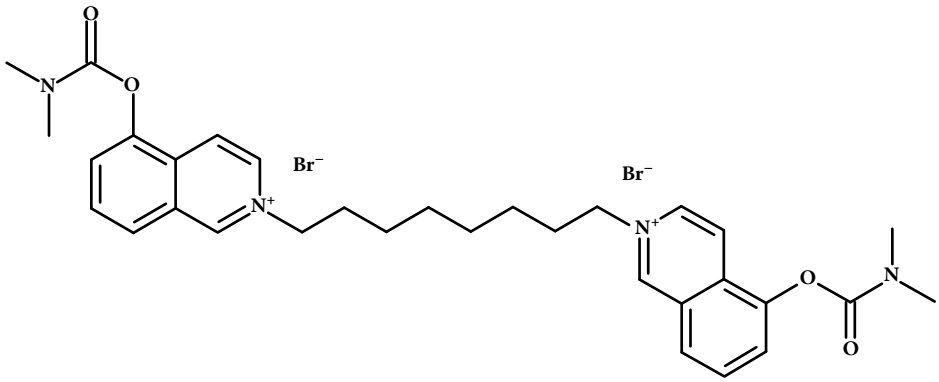
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



$C_{32}\ H_{40}\ N_4\ O_4 \cdot Br_2$

Solid. Various other salts have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be just as toxic as VX (C01-A017).

Properties:

MW: 704.5	*VP:* Negligible	*FlP:* —
D: —	*VD:* —	*LEL:* —
MP: 250°–257°F	*Vlt:* —	*UEL*: —
BP: —	*H_2O:* Soluble	*RP:* Persistent
Vsc: —	*Sol:* —	*IP:* —

C02-A016

1,8-Bis[N-(2-Dimethylcarbamoxybenzyl)-N,N-dimethylammonio]octane-2,7-dione Dibromide

CAS: 110801-39-3

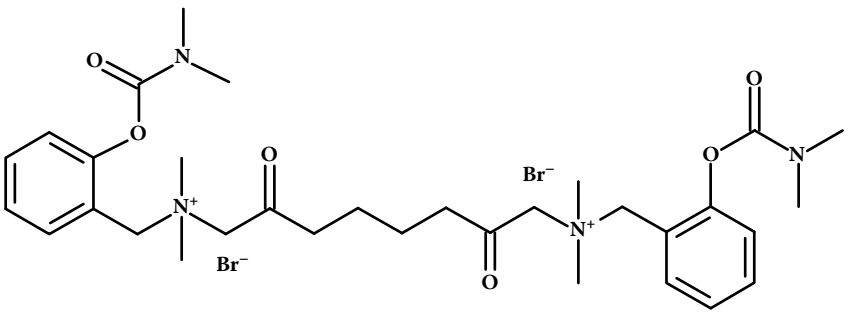
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



$C_{32}\ H_{48}\ N_4\ O_6 \cdot Br_2$

White crystalline solid. Various other salts have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be just as toxic as VX (C01-A017).

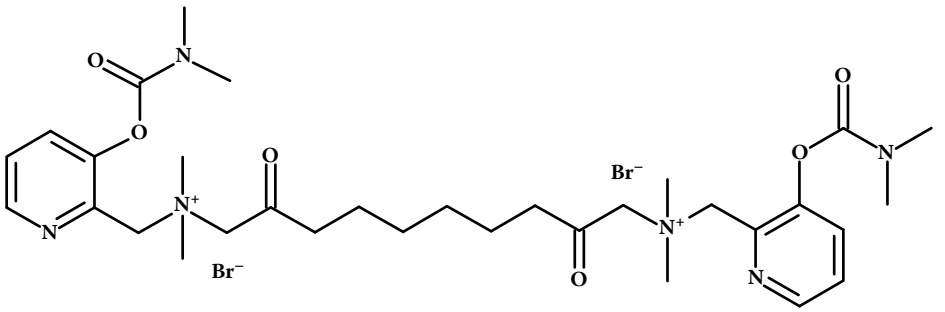
Properties:

MW: 744.6	*VP:* Negligible	*FlP:* —
D: —	*VD:* —	*LEL:* —
MP: 329°–336°F	*Vlt:* —	*UEL*: —
BP: —	*H_2O:* Soluble	*RP:* Persistent
Vsc: —	*Sol:* Acetonitrile	*IP:* —

C02-A017

1,10-Bis[N-(3-dimethylcarbamoxy-α-picolyl)-N,N-dimethylammonio]decane-2,9-dione Dibromide

CAS: 77103-99-2
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_{32}\ H_{50}\ N_6\ O_6 \cdot Br_2$

Crystalline solid. Various other salts have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be approximately three times more toxic than VX (C01-A017).

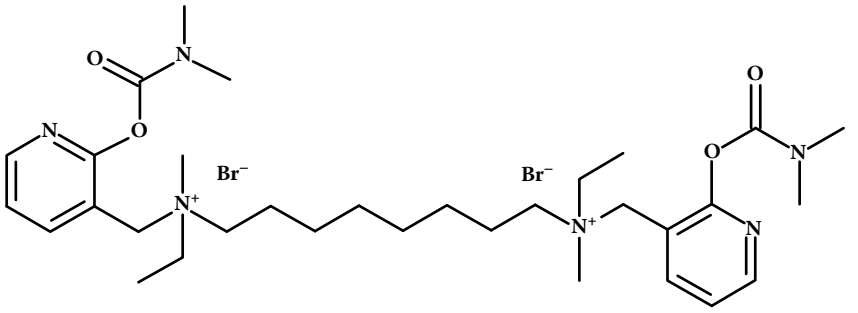
Properties:

MW: 774.6	*VP:* Negligible	*FlP:* —
D: —	*VD:* —	*LEL:* —
MP: 336°F	*Vlt:* —	*UEL*: —
BP: —	*H_2O:* Soluble	*RP:* Persistent
Vsc: —	*Sol:* —	*IP:* —

C02-A018

1,8-Bis[(3-dimethylcarbamoxy-α-picolinyl)ethylamino]octane Dimethobromide

CAS: 113402-83-8
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_{32}\ H_{54}\ N_6\ O_4 \cdot Br_2$

White crystalline solid. Various other salts have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be approximately twice as toxic as VX (C01-A017).

Properties:

MW: 746.3	*VP:* Negligible	*FlP:* —
D: —	*VD:* —	*LEL:* —
MP: 282°F	*Vlt:* —	*UEL*: —
BP: —	*H_2O:* Soluble	*RP:* Persistent
Vsc: —	*Sol:* Acetonitrile	*IP:* —

C02-A019

1,10-Bis[N-(2-dimethylcarbamoxybenzyl)-N,N-dimethylammonio]decane-2,9-dione Dibromide

CAS: 110801-36-0

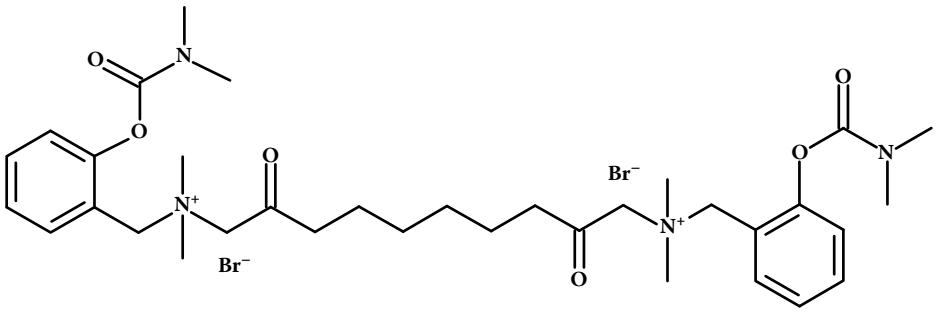
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



$C_{34}\ H_{52}\ N_4\ O_6 \cdot Br_2$

White crystalline solid. Various other salts have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be slightly more toxic than VX (C01-A017).

Properties:

MW: 772.6	*VP:* Negligible	*FlP:* —
D: —	*VD:* —	*LEL:* —
MP: 372°–376°F	*Vlt:* —	*UEL*: —
BP: —	*H_2O:* Soluble	*RP:* Persistent
Vsc: —	*Sol:* Acetonitrile	*IP:* —

C02-A020

1,10-Bis[N-(3-dimethylcarbamoxy-α-picolyl)-N-ethyl-N-methylammonio]decane-2,9-dione Dibromide

CAS: 77104-00-8

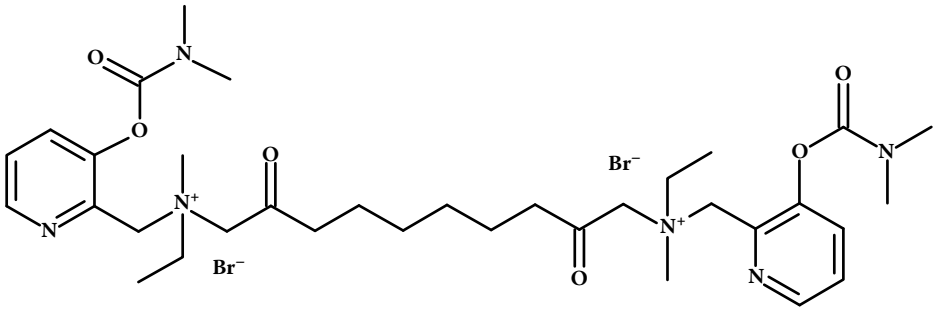
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



$C_{34}\ H_{54}\ N_6\ O_6 \cdot Br_2$

Crystalline solid. Various other salts have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be approximately twice as toxic as VX (C01-A017).

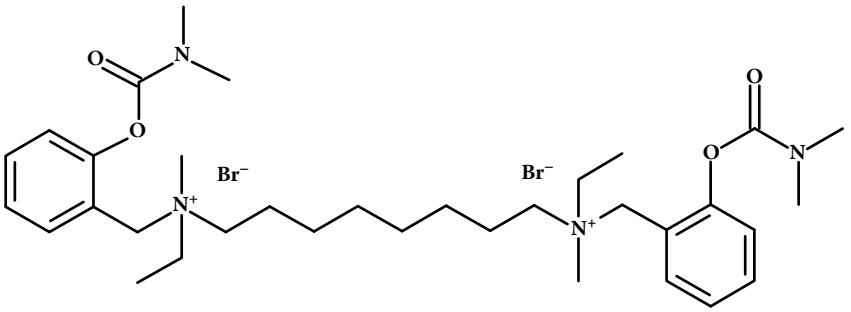
Properties:

MW: 802.7	*VP:* Negligible	*FlP:* —
D: —	*VD:* —	*LEL:* —
MP: Decomposes	*Vlt:* —	*UEL*: —
BP: —	*H_2O:* Soluble	*RP:* Persistent
Vsc: —	*Sol:* Acetonitrile	*IP:* —

C02-A021

1,8-Bis[(2-Dimethylcarbamoxybenzyl)ethylamino]octane Dimethobromide

CAS: 117585-55-4
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_{34}\ H_{56}\ N_4\ O_4 \cdot Br_2$

White crystalline solid. Various other salts have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be slightly more toxic than VX (C01-A017).

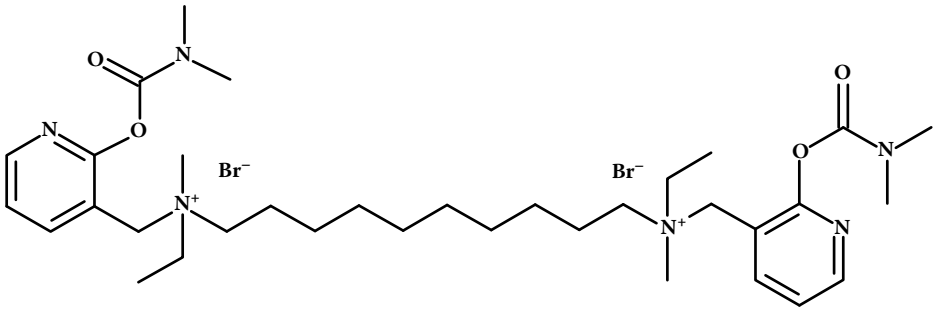
Properties:

MW: 744.3	*VP:* Negligible	*FlP:* —
D: —	*VD:* —	*LEL:* —
MP: 349°F	*Vlt:* —	*UEL*: —
BP: —	*H_2O:* Soluble	*RP:* Persistent
Vsc: —	*Sol:* Acetonitrile	*IP:* —

C02-A022

1,10-Bis[(3-dimethylcarbamoxy-α-picolinyl)ethylamino]decane Dimethobromide

CAS: 113402-82-7
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_{34}\ H_{58}\ N_6\ O_4 \cdot Br_2$

White crystalline solid. Various other salts have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be approximately twice as toxic as VX (C01-A017).

Properties:

MW: 774.3	*VP:* Negligible	*FlP:* —
D: —	*VD:* —	*LEL:* —
MP: 343°F	*Vlt:* —	*UEL*: —
BP: —	*H_2O:* Soluble	*RP:* Persistent
Vsc: —	*Sol:* Acetonitrile	*IP:* —

C02-A023

1,10-Bis{N-[1-(2-dimethylcarbamoxyphenyl)ethyl]-N,N-dimethylammonio}decane-2,9-dione Tetraphenylboronate

CAS: 110801-38-2

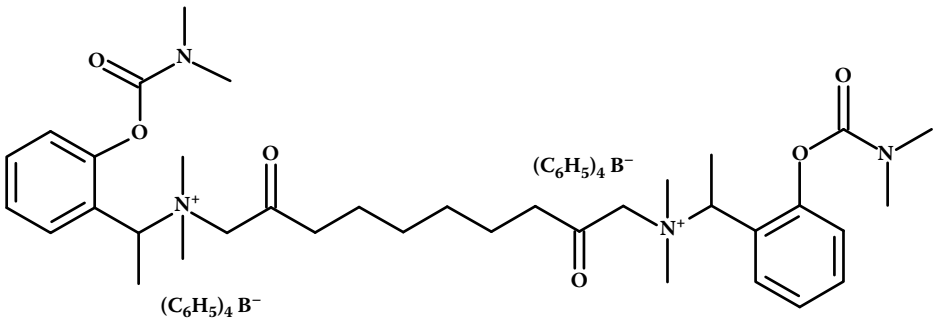
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



$C_{36}\ H_{56}\ N_4\ O_6 \cdot B_2\ C_{48}\ H_{40}$

Crystalline solid. Bromide salt is a hygroscopic white solid. Various other salts have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be slightly more toxic than VX (C01-A017).

Properties:

MW: 1,279.3	*VP:* Negligible	*FlP:* —
D: —	*VD:* —	*LEL:* —
MP: 180°–183°F	*Vlt:* —	*UEL*: —
BP: —	*H_2O:* Insoluble	*RP:* Persistent
Vsc: —	*Sol:* —	*IP:* —

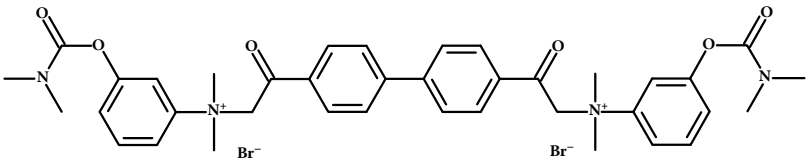
Bromide Salt

MW: 800.7
H_2O: Soluble
Sol: Acetonitrile

C02-A024

Bis{α-[(3-dimethylcarbamoxyphenyl)methylamino]}-4,4′-biacetophenone Dimethobromide

CAS: 113402-23-6
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_{38}\ H_{44}\ N_4\ O_6 \cdot Br_2$

Light yellow crystalline solid. Various other salts have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be approximately half as toxic as VX (C01-A017).

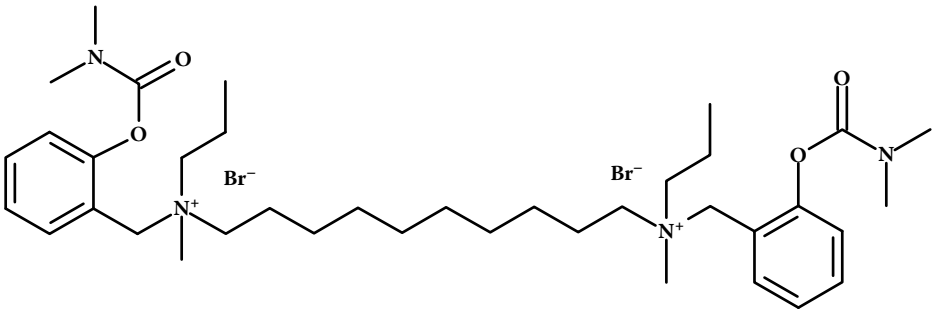
Properties:

MW: 812.2	*VP:* Negligible	*FlP:* —
D: —	*VD:* —	*LEL:* —
MP: 302°F	*Vlt:* —	*UEL*: —
BP: —	*H_2O:* Soluble	*RP:* Persistent
Vsc: —	*Sol:* Alcohols	*IP:* —

C02-A025

1,10-Bis[(2-dimethylcarbamoxybenzyl)propylamino]decane Dimethobromide

CAS: 117569-53-6
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_{38}\ H_{64}\ N_4\ O_4 \cdot Br_2$

White crystalline solid. Various other salts have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be just as toxic as VX (C01-A017).

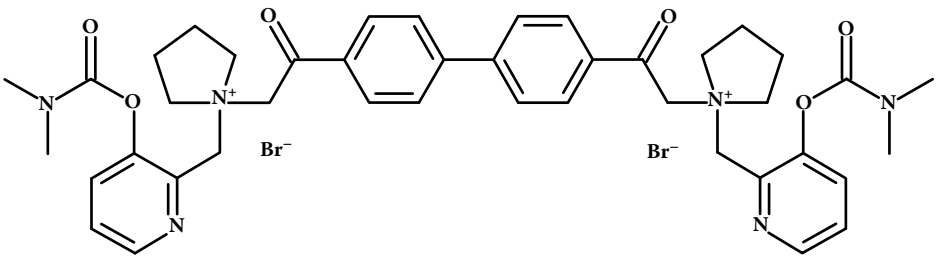
Properties:

MW: 800.4	*VP:* Negligible	*FlP:* —
D: —	*VD:* —	*LEL:* —
MP: 180°F	*Vlt:* —	*UEL*: —
BP: —	*H_2O:* Soluble	*RP:* Persistent
Vsc: —	*Sol:* Acetonitrile	*IP:* —

C02-A026

Bis{α-[(3-dimethylcarbamoxy-α-picolinyl)pyrrolidinio]}4,4′-biacetophenone Dibromide

CAS: 113402-25-8
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_{42}\ H_{50}\ N_6\ O_6 \cdot Br_2$

Crystalline solid. Various other salts have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be approximately half as toxic as VX (C01-A017).

Properties:

MW: 893.3	*VP:* Negligible	*FlP:* —
D: —	*VD:* —	*LEL:* —
MP: Decomposes	*Vlt:* —	*UEL*: —
BP: —	*H_2O:* Soluble	*RP:* Persistent
Vsc: —	*Sol:* Alcohols	*IP:* —

C02-A027

1-(4-Dimethylcarbamoxy-2-dimethylaminophenoxy)-3-(4-dimethylaminophenoxy)propane Dimethiodide

CAS: 58149-55-6

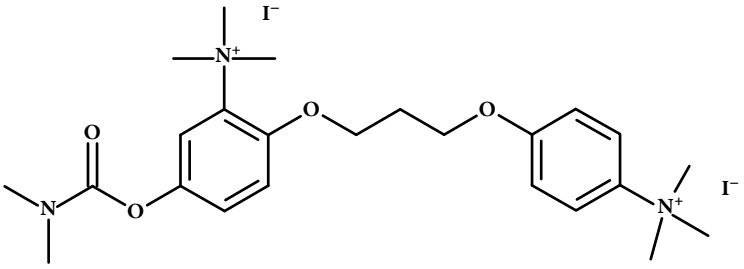
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



$C_{24}\ H_{37}\ N_3\ O_4 \cdot I_2$

Solid. Various other salts have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be approximately one-fifth as toxic as VX (C01-A017).

Properties:

MW: 685.4	*VP:* Negligible	*FlP:* —
D: —	*VD:* —	*LEL:* —
MP: 349°–360°F	*Vlt:* —	*UEL*: —
BP: —	H_2O: Soluble	*RP:* Persistent
Vsc: —	*Sol:* —	*IP:* —

Oxalate Salt

MW: 591.4

MP: 329°F

C02-A028

1-(N,N,N-Trimethylammonio)-8-[N-(2-dimethylcarbamoxybenzyl)-N,N-dimethylammonio] octane Dibromide

CAS: 77104-70-2

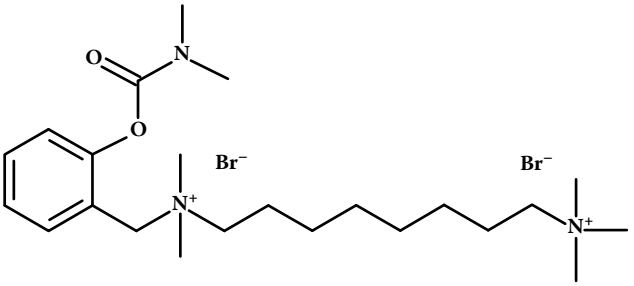
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



$C_{23}\ H_{43}\ N_3\ O_2 \cdot Br_2$

Hygroscopic white crystalline solid. Various other salts have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be just as toxic as VX (C01-A017).

Properties:

MW: 553.4	*VP:* Negligible	*FlP:* —
D: —	*VD:* —	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: —	H_2O: Soluble	*RP:* Persistent
Vsc: —	*Sol:* Acetonitrile	*IP:* —

C02-A029

1-(N,N,N-Trimethylammonio)-10-[N-(5-dimethylcarbamoxy)isoquinolinio]decane Dibromide

CAS: 77223-00-8

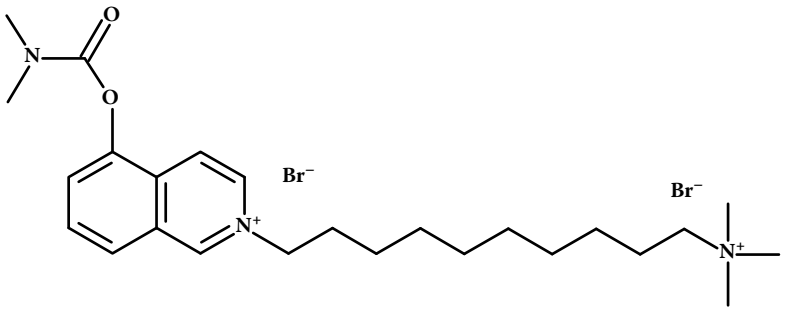
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



$C_{25}\ H_{41}\ N_3\ O_2 \cdot Br_2$

Deliquescent crystalline solid. Various other salts have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be approximately one-third as toxic as VX (C01-A017).

Properties:

MW: 575.4	*VP:* Negligible	*FlP:* —
D: —	*VD:* —	*LEL:* —
MP: —	*Vlt:* —	*UEL:* —
BP: —	*H_2O:* Soluble	*RP:* Persistent
Vsc: —	*Sol:* Acetonitrile	*IP:* —

C02-A030

1-[N-(2-Dimethylcarbamoxybenzyl)pyrrolinio]-8-(N,N,N-trimethylammonio)octane Dibromide

CAS: 77111-74-1

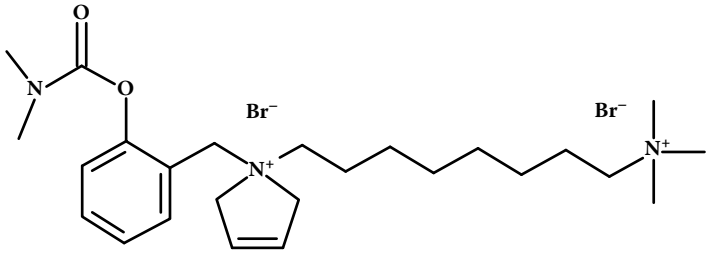
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



$C_{25}\ H_{43}\ N_3\ O_2 \cdot Br_2$

Deliquescent white solid. Various other salts have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be slightly more toxic than VX (C01-A017).

Properties:

MW: 577.4	*VP:* Negligible	*FlP:* —
D: —	*VD:* —	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: —	*H_2O:* Soluble	*RP:* Persistent
Vsc: —	*Sol:* Acetonitrile	*IP:* —

C02-A031

1-(N,N-Dimethyl-N-cyanomethylammonio)-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Dibromide

CAS: 109973-92-4

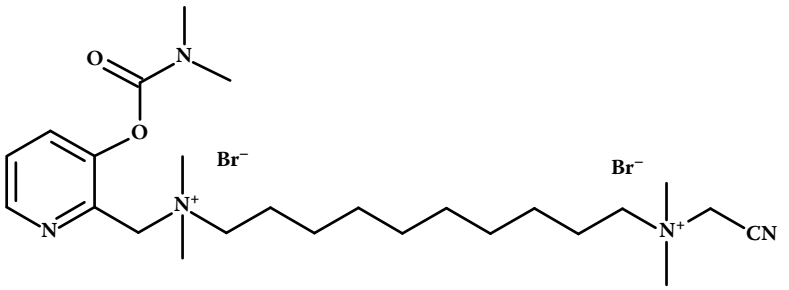
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



$C_{25}\ H_{45}\ N_5\ O_2 \cdot Br_2$

White crystalline solid. Various other salts have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be slightly more toxic than VX (C01-A017).

Properties:

MW: 607.5	*VP:* Negligible	*FlP:* —
D: —	*VD:* —	*LEL:* —
MP: —	*Vlt:* —	*UEL:* —
BP: —	*H_2O:* Soluble	*RP:* Persistent
Vsc: —	*Sol:* Alcohols, Acetonitrile	*IP:* —

C02-A032

1-[N-(3-Dimethylcarbamoxy-α-picolyl)-N,N-dimethylammonio]-10-(N-carbamoxymethyl-N,N-dimethylammonio)decane Dibromide

CAS: 78297-56-0

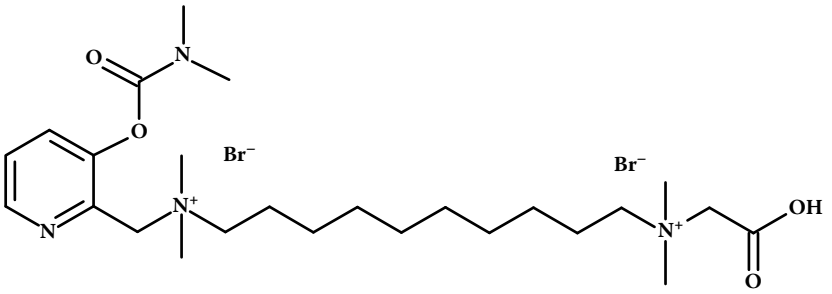
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



$C_{25}\ H_{46}\ N_4\ O_4 \cdot Br_2$

Deliquescent white crystalline solid. Various other salts have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be approximately half as toxic as VX (C01-A017).

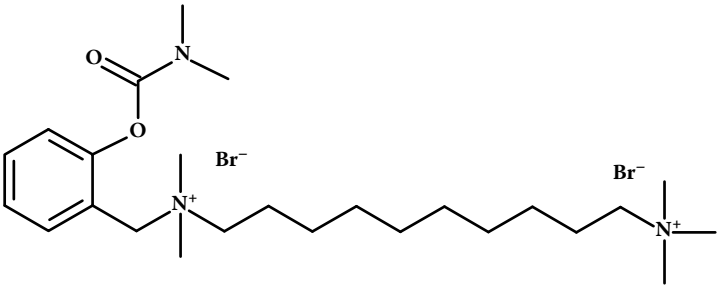
Properties:

MW: 626.5	*VP:* Negligible	*FlP:* —
D: —	*VD:* —	*LEL:* —
MP: —	*Vlt:* —	*UEL:* —
BP: —	*H_2O:* Soluble	*RP:* Persistent
Vsc: —	*Sol:* Acetonitrile	*IP:* —

C02-A033

1-(N,N,N-Trimethylammonio)-10-[N-(2-dimethylcarbamoxybenzyl)-N,N-dimethylammonio] decane Dibromide

CAS: 77104-68-8
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_{25}\ H_{47}\ N_3\ O_2 \cdot Br_2$

White crystalline solid. Various other salts have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be just as toxic as VX (C01-A017).

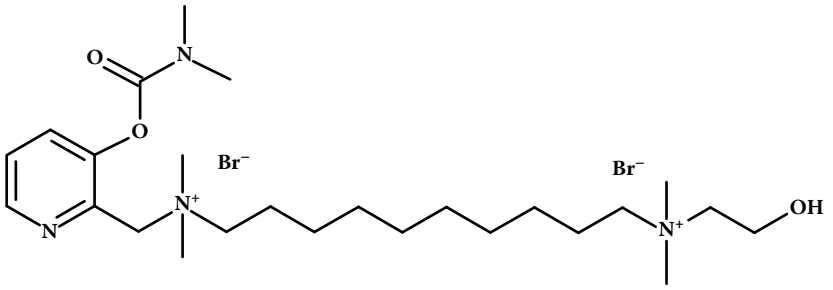
Properties:

MW: 581.5	*VP:* Negligible	*FlP:* —
D: —	*VD:* —	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: —	*H_2O:* Soluble	*RP:* Persistent
Vsc: —	*Sol:* Acetonitrile	*IP:* —

C02-A034

1-[N,N-Dimethyl-N-(2-hydroxy)ethylammonio]-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Dibromide

CAS: 77104-62-2
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_{25}\ H_{48}\ N_4\ O_3 \cdot Br_2$

White crystalline solid. Various other salts have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be approximately twice as toxic as VX (C01-A017).

Properties:

MW: 612.5	*VP:* Negligible	*FlP:* —
D: —	*VD:* —	*LEL:* —
MP: —	*Vlt:* —	*UEL:* —
BP: —	*H_2O:* Soluble	*RP:* Persistent
Vsc: —	*Sol:* Alcohols, acetonitrile	*IP:* —

C02-A035

1-Pyridinio-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Dibromide

CAS: 77223-01-9

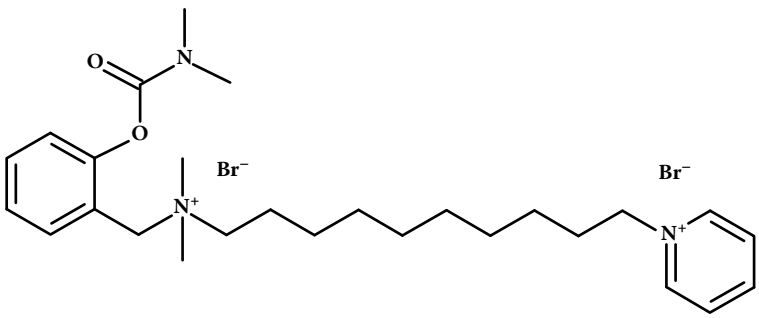
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



$C_{26}\ H_{42}\ N_4\ O_2 \cdot Br_2$

Deliquescent crystalline solid. Various other salts have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be just as toxic as VX (C01-A017).

Properties:

MW: 602.5	*VP:* Negligible	*FlP:* —
D: —	*VD:* —	*LEL:* —
MP: —	*Vlt:* —	*UEL:* —
BP: —	*H_2O:* Soluble	*RP:* Persistent
Vsc: —	*Sol:* Alcohols, pyridine	*IP:* —

C02-A036

1-(N-Methyl)pyrrolidinio-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio] decane Dibromide

CAS: 110344-83-7

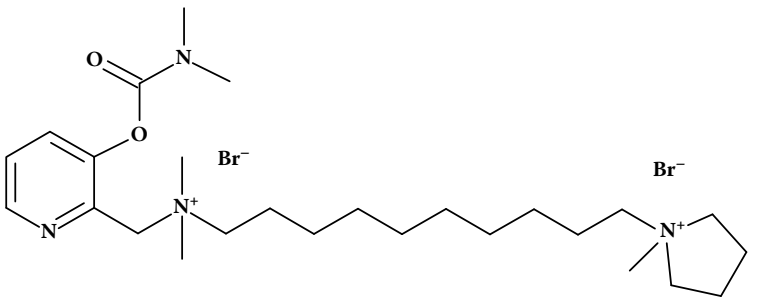
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



$C_{26}\ H_{48}\ N_4\ O_2 \cdot Br_2$

Deliquescent white solid. Various other salts have been reported.
This material is on Schedule 1 of the CWC.

Exposure Hazards

Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be slightly more toxic than VX (C01-A017).

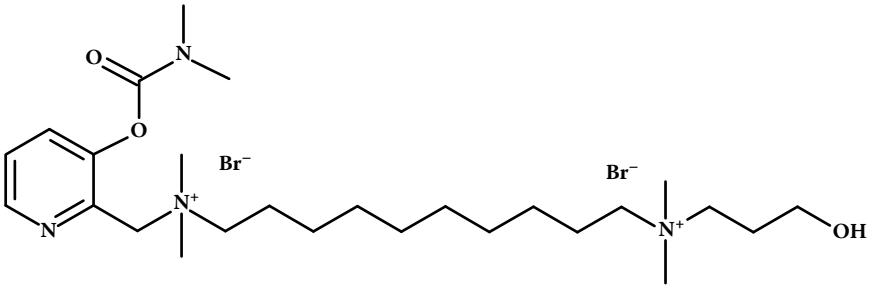
Properties:

MW: 608.5	*VP:* Negligible	*FlP:* —
D: —	*VD:* —	*LEL:* —
MP: —	*Vlt:* —	*UEL:* —
BP: —	*H_2O:* Soluble	*RP:* Persistent
Vsc: —	*Sol:* Acetonitrile	*IP:* —

C02-A037

1-[N,N-Dimethyl-N-(3-hydroxy)propylammonio]-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Dibromide

CAS: 77104-63-3
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_{26}\ H_{50}\ N_4\ O_3 \cdot Br_2$

Deliquescent white solid. Various other salts have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be slightly more toxic than VX (C01-A017).

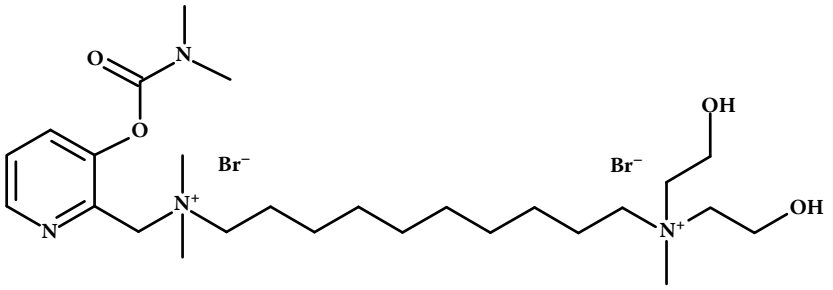
Properties:

MW: 626.5	*VP:* Negligible	*FlP:* —
D: —	*VD:* —	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: —	*H_2O:* Soluble	*RP:* Persistent
Vsc: —	*Sol:* Alcohols, acetonitrile	*IP:* —

C02-A038

1-[N,N-Di(2-hydroxy)ethyl-N-methylammonio]-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Dibromide

CAS: 77104-64-4
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_{26}\ H_{50}\ N_4\ O_4 \cdot Br_2$

Deliquescent white solid. Various other salts have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be slightly more toxic than VX (C01-A017).

Properties:

MW: 642.5	*VP:* Negligible	*FlP:* —
D: —	*VD:* —	*LEL:* —
MP: —	*Vlt:* —	*UEL:* —
BP: —	*H_2O:* Soluble	*RP:* Persistent
Vsc: —	*Sol:* Acetonitrile	*IP:* —

C02-A039

1-(4-Aldoximino)pyridinio-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio] decene Dibromide

CAS: 77223-02-0

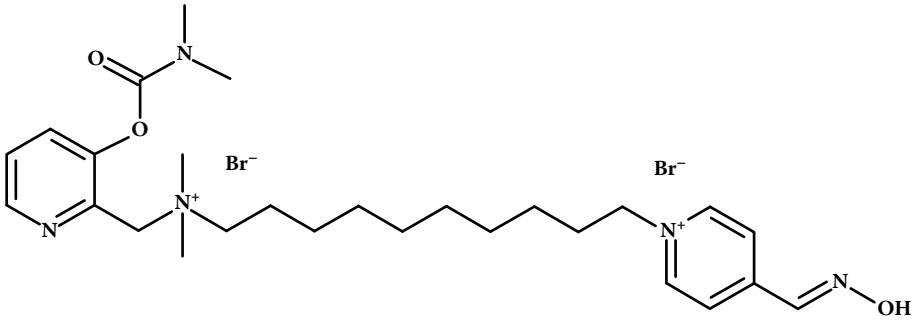
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



$C_{27}\ H_{43}\ N_5\ O_3 \cdot Br_2$

Deliquescent crystalline solid. Various other salts have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be slightly more toxic than VX (C01-A017).

Properties:

MW: 645.5	*VP:* Negligible	*FlP:* —
D: —	*VD:* —	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: —	*H_2O:* Soluble	*RP:* Persistent
Vsc: —	*Sol:* Acetonitrile	*IP:* —

C02-A040

1-[N-(2-Dimethylcarbamoxybenzyl)pyrrolinio]-10-(N,N,N-trimethylammonio)decane Dibromide

CAS: 77111-71-8

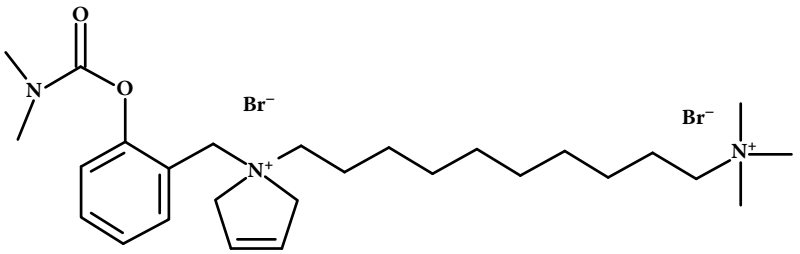
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



$C_{27}\ H_{47}\ N_3\ O_2 \cdot Br_2$

Deliquescent white crystalline solid. Various other salts have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be just as toxic as VX (C01-A017).

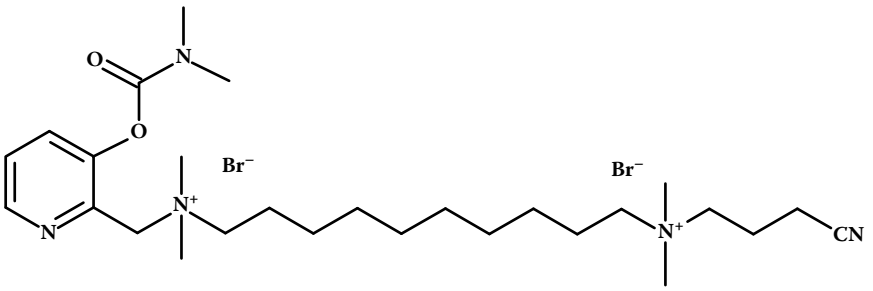
Properties:

MW: 605.5	*VP:* Negligible	*FlP:* —
D: —	*VD:* —	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: —	*H_2O:* Soluble	*RP:* Persistent
Vsc: —	*Sol:* Acetonitrile	*IP:* —

C02-A041

1-[N,N-Dimethyl-N-(3-cyanopropyl)ammonio]-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Dibromide

CAS: 109973-93-5
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_{27}\ H_{49}\ N_5\ O_2 \cdot Br_2$

Deliquescent white crystalline solid. Various other salts have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be slightly more toxic than VX (C01-A017).

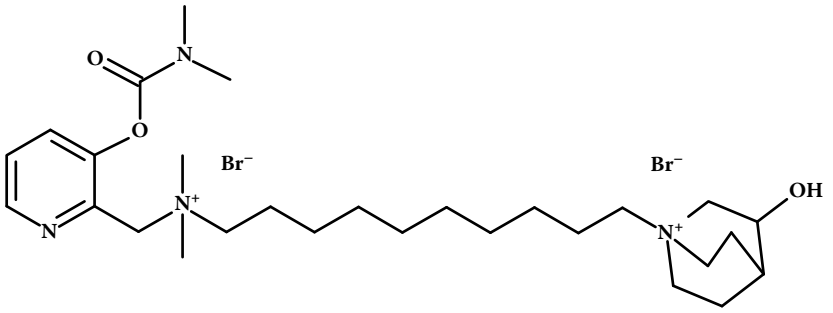
Properties:

MW: 635.5	*VP:* Negligible	*FlP:* —
D: —	*VD:* —	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: —	*H_2O:* Soluble	*RP:* Persistent
Vsc: —	*Sol:* Alcohols, acetonitrile	*IP:* —

C02-A042

1-(3-Hydroxy)quinuclidinio-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio] decane Dibromide

CAS: 110344-82-6
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_{28}\ H_{50}\ N_4\ O_3 \cdot Br_2$

Deliquescent white solid. Various other salts have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be slightly more toxic than VX (C01-A017).

Properties:

MW: 650.5	*VP:* Negligible	*FlP:* —
D: —	*VD:* —	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: —	*H_2O:* Soluble	*RP:* Persistent
Vsc: —	*Sol:* Alcohols	*IP:* —

C02-A043

1-[N,N-Dimethyl-N-(2-acetoxy-2-methylethyl)ammonio]-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Dibromide

CAS: 110914-01-7

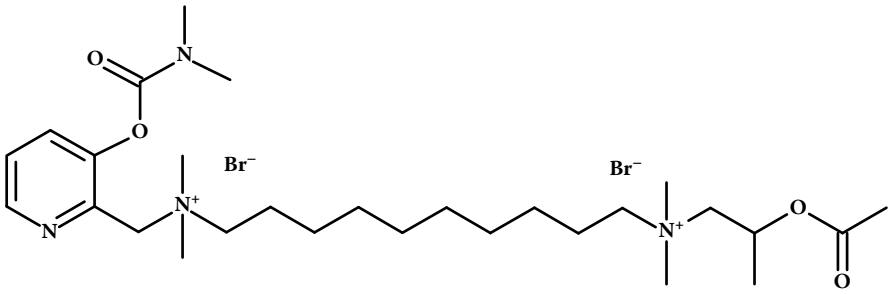
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



$C_{28}\ H_{52}\ N_4\ O_4 \cdot Br_2$

Deliquescent white solid. Various other salts have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be just as toxic as VX (C01-A017).

Properties:

MW: 668.6	*VP:* Negligible	*FlP:* —
D: —	*VD:* —	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: —	*H_2O:* Soluble	*RP:* Persistent
Vsc: —	*Sol:* Acetonitrile	*IP:* —

C02-A044

1-[N-(3-Hydroxy-α-picolyl)-N,N-dimethylammonio]-10-[N-(3-dimethylcarbamoxy-α-picolyl)-N,N-dimethylammonio]decane Dibromide

CAS: 77104-09-7

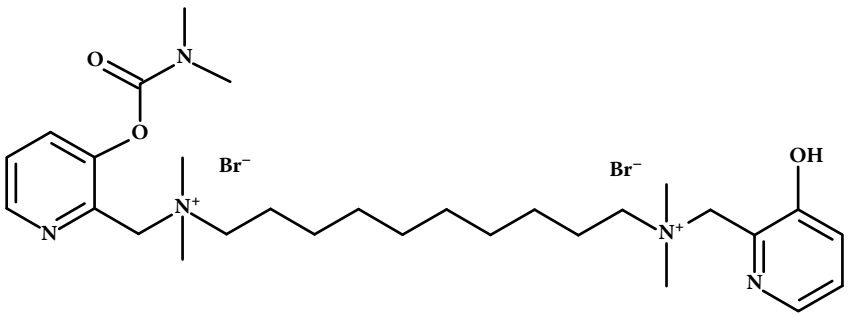
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



$C_{29}\ H_{49}\ N_5\ O_3 \cdot Br_2$

Deliquescent white crystalline solid. Various other salts have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be slightly more toxic than VX (C01-A017).

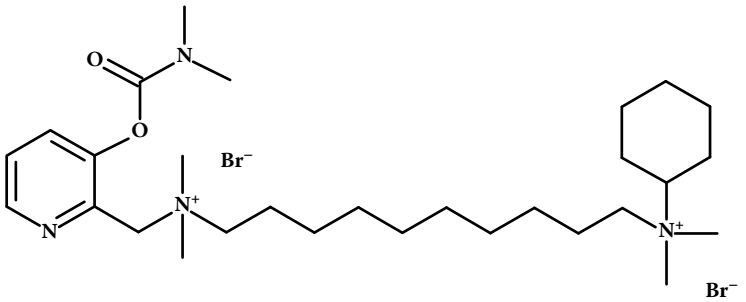
Properties:

MW: 675.6	*VP:* Negligible	*FlP:* —
D: —	*VD:* —	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: —	*H_2O:* Soluble	*RP:* Persistent
Vsc: —	*Sol:* Acetonitrile	*IP:* —

C02-A045

1-(N,N-Dimethyl-N-cyclohexylammonio)-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Dibromide

CAS: 109973-95-7
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_{29}\ H_{54}\ N_4\ O_2 \cdot Br_2$

White solid. Various other salts have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be approximately half as toxic as VX (C01-A017).

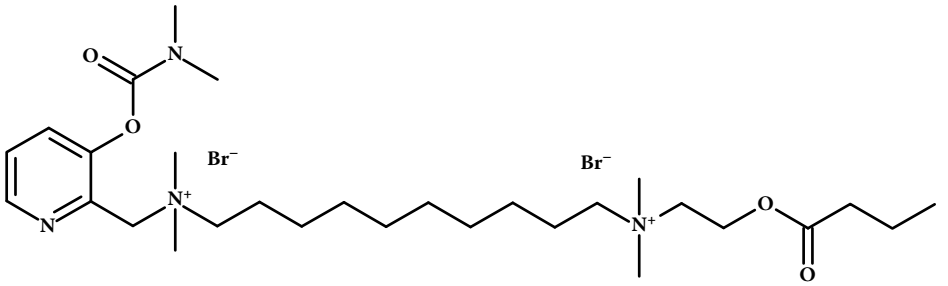
Properties:

MW: 650.6	*VP:* Negligible	*FlP:* —
D: —	*VD:* —	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: —	*H_2O:* Soluble	*RP:* Persistent
Vsc: —	*Sol:* Alcohols	*IP:* —

C02-A046

1-[N,N-Dimethyl-N-(2-butyroxyethyl)ammonio]-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Dibromide

CAS: 110914-02-8
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_{29}\ H_{54}\ N_4\ O_4 \cdot Br_2$

Hygroscopic white solid. Various other salts have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be slightly more toxic than VX (C01-A017).

Properties:

MW: 682.6	*VP:* Negligible	*FlP:* —
D: —	*VD:* —	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: —	*H_2O:* Soluble	*RP:* Persistent
Vsc: —	*Sol:* Acetonitrile, chloroform	*IP:* —

C02-A047

1-(N,N,N-Tributylammonio)-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Dibromide

CAS: 109973-94-6

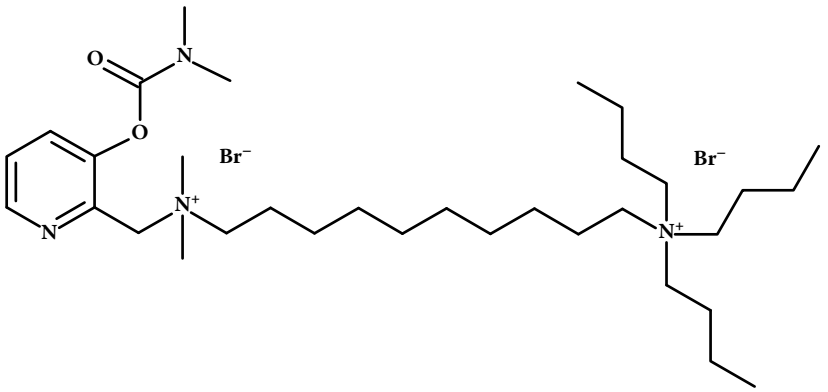
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



$C_{33}\ H_{64}\ N_4\ O_2 \cdot Br_2$

Deliquescent white solid. Various other salts have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be slightly more toxic than VX (C01-A017).

Properties:

MW: 708.7	*VP:* Negligible	*FlP:* —
D: —	*VD:* —	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: —	*H_2O:* Soluble	*RP:* Persistent
Vsc: —	*Sol:* Alcohols, acetonitrile, chloroform	*IP:* —

C02-A048

1-[N-(4-Dimethylcarbamoxymethyl)benzyl-N,N-dimethylammonio]-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Dibromide

CAS: 77104-59-7

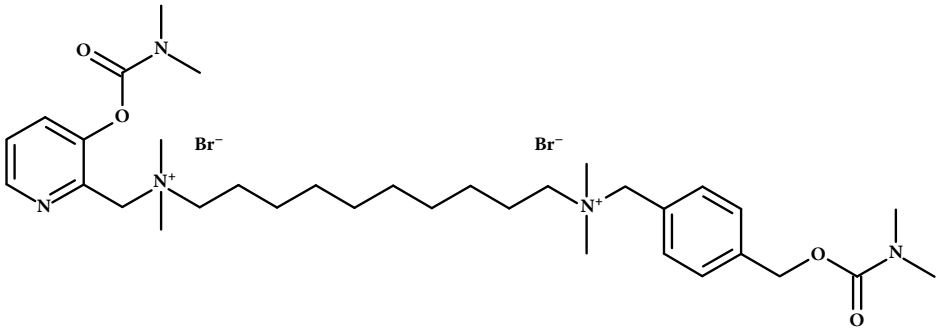
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



$C_{34}\ H_{57}\ N_5\ O_4 \cdot Br_2$

Deliquescent white crystalline solid. Various other salts have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be just as toxic as VX (C01-A017).

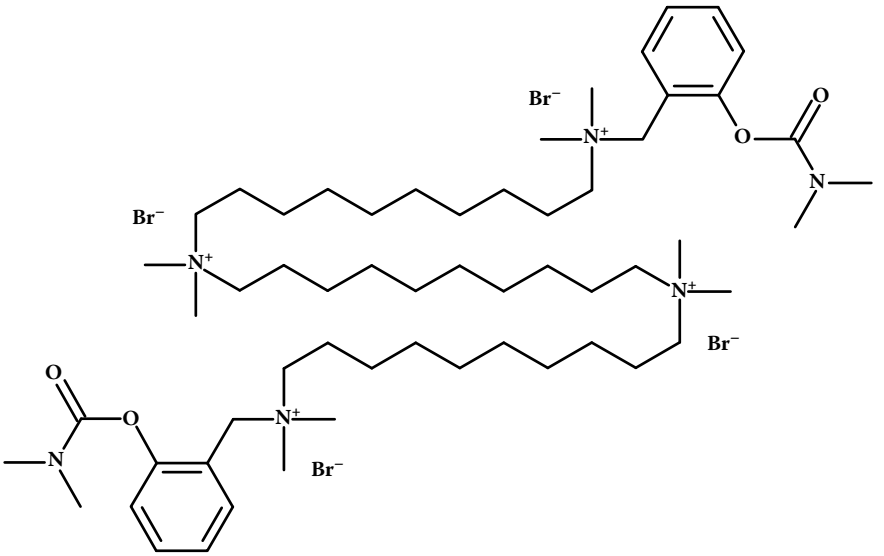
Properties:

MW: 759.7	*VP:* Negligible	*FlP:* —
D: —	*VD:* —	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: —	*H_2O:* Soluble	*RP:* Persistent
Vsc: —	*Sol:* Acetonitrile	*IP:* —

C02-A049

1,10-Bis{[10-(3-dimethylcarbamoxy-α-picolinyl)methylaminodecyl]methylamino}decane Tetramethobromide

CAS: 110255-20-4
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_{56}\ H_{106}\ N_8\ O_4 \cdot Br_4$

Hygroscopic white solid. Various other salts have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be just as toxic as VX (C01-A017).

Properties:

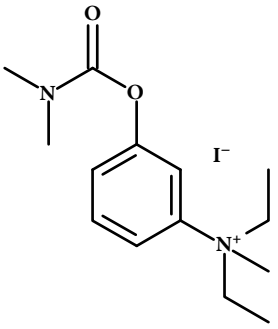
MW: 1,275.1	*VP:* Negligible	*FlP:* —
D: —	*VD:* —	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: —	*H_2O:* Soluble	*RP:* Persistent
Vsc: —	*Sol:* Acetonitrile	*IP:* —

C02-A050

3-[(Dimethylcarbamoyl)oxy]-*N*,*N*-diethyl-*N*-methylanilinium Iodide (TL-1238)

CAS: 6249-65-6
RTECS: —
UN: —
EC: —

UNII: —
ICD-11: —



C_{14} H_{23} I N_2 O_2

Specific information is not available for this material. Various other salts have been reported.

This material is on Schedule 1 of the CWC.

Exposure Hazards

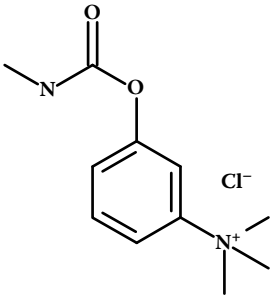
Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be approximately one-fifth as toxic as VX (C01-A017).

Properties:

MW: 378.3	*VP:* 0.002 mmHg (est.)	*FlP:* —
D: —	*VD:*13	*LEL:* —
MP: 330°F (est.)	*Vlt:* —	*UEL*: —
BP: 640°F (est.)	*ER:* —	*RP:* —
Vsc: —	*H_2O:* 0.02% (est.)	*IP:* —
	Sol: —	

C02-A051

Trimethyl-[3-(methylcarbamoyloxy)phenyl]azanium, Chloride (T-1123)
CAS: 64051-06-5
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



C_{11} H_{17} Cl N_2 O_2

Specific information is not available for this material. Various other salts have been reported.

Exposure Hazards

Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be between 10% and 20% as toxic as VX (C01-A017).

Properties:

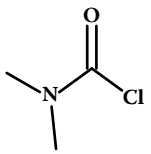
MW: 244.7	*VP:* 5.9×10^{-4} mmHg (est.)	*FlP:* —
D: —	*VD:* 8.4	*LEL:* —
MP: 310°F (est.)	*Vlt:* —	*UEL*: —
BP: 612°F (est.)	*ER:* —	*RP:* —
Vsc: —	*H_2O:* 0.1% (est.)	*IP:* —
	Sol: —	

C02-C COMPONENTS AND PRECURSORS

C02-C052

Dimethylcarbamoyl Chloride

CAS: 79-44-7
RTECS: FD4200000
UN: 2262; 156
EC: 201-208-6
UNII: 5D54S95GT6
ICD-11: —



C_3 H_6 Cl N O

Clear, colorless to yellow liquid with a pungent odor. This material is a lachrymator, and causes burns to skin, eyes and mucous membranes.

Used industrially for manufacture of dyes and pharmaceuticals.

Exposure Hazards

Conversion Factor: 1 ppm = 4.40 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.014 ppm; Mar: 2.3 ppm; Crit: 110 ppm; Cat: —
PAC-1: 0.015 ppm; *PAC-2:* 1.5 ppm; *PAC-3:* 9.1 ppm
TLV: 0.005 ppm [Skin]

Properties:

MW: 107.5	*VP:* 1.95 mmHg (77°F)	*FlP:* 155°F
D: 1.2 g/mL	*VD:* 3.7	*LEL:* 4.8%
MP: –27°F	*Vlt:* 2,600 ppm	*UEL*: 19.2%

BP: 334°F	*ER:* —	*RP:* 4.9
Vsc: —	*H_2O:* Reacts	*IP:* —
	Sol: —	

C02-C053

2-Dimethylaminomethyl-3-hydroxypyridine

CAS: 2168-13-0

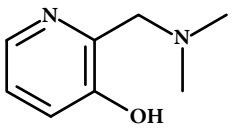
RTECS: —

UN: —

EC: 218-510-9

UNII: —

ICD-11: —



$C_8\ H_{12}\ N_2\ O$

White solid; technical grade material may be a brown crystalline powder. Various salts (solids) have been reported. This material causes respiratory and skin irritation, as well as producing serious eye damage

Used industrially as an antiknock additive in fuels.

Exposure Hazards

Conversion Factor: 1 ppm = 6.22 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 152.2	*VP:* 0.0241 mmHg (77°F)	*FlP:* 263°F
D: 1.1 g/mL	*VD:* 5.3	*LEL:* —
MP: 133°F–138°F	*Vlt:* 32 ppm (77°F)	*UEL*: —
BP: 208°F (4 mmHg)	*ER:* —	*RP:* 340
Vsc: —	*H_2O:* —	*IP:* —
	Sol: —	

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Vesicant/Urticant Agents



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3 Sulfur and Nitrogen Vesicants

GENERAL INFORMATION

The agents in this class are beta-halogenated thioethers, beta-halogenated alkylamines and alkylating sulfates. The thioether agents are listed in Schedule 1 of the Chemical Weapons Convention. Only three beta-halogenated alkylamines agents, HN1 (C03-A016), HN2 (C03-A017), and HN3 (C03-A018), are specifically listed in Schedule 1. However, because of the toxicity of the agents and limited commercial application, the remaining alkylamines would be prohibited base on the Guidelines for Schedules of Chemicals.

Sulfur vesicants were used in World War I. Mustard gas (C03-A001) was discovered in 1822. It was first employed by the Germans in 1917 at the 3rd Battle of Ypres and has been considered a major chemical agent ever since. Nitrogen vesicants were developed just prior to World War II. In addition to their vesicant properties, nitrogen agents were studied as a means of poisoning an enemy's water supply because dilute aqueous solutions will rapidly decompose to form neurotoxic products. Several of these agents, including HN3 (C03-A018), were stockpiled by Nazi Germany during World War II but were never used. Modern weapons researchers have isolated and evaluated numerous other variations of the basic thiol and amine structures.

Both sulfur and nitrogen vesicants are easy to synthesize and disperse. For information on some of the chemicals used to manufacture vesicants, see the component section (C03-C) following information on the individual agents.

In addition to the agents detailed in this handbook, the OPCW identifies other agents in this class in its "Handbook on Chemicals 2019," Appendix 2 in the *Declarations Handbook for the Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction*. However, no information is available in the unclassified literature concerning the physical, chemical, or toxicological properties of these additional agents.

Sulfur vesicants have been stockpiled by all countries that have pursued a chemical weapons program and have been used numerous times on the battlefield. In contrast, although nitrogen vesicants have been investigated by the United States and many other countries, concern over agent stability and a lack of a clear strategic, tactical, or production advantage over sulfur vesicants has prevented further stockpiling of these agents.

TOXICOLOGY

Effects

Sulfur and nitrogen vesicants produce their toxic effects by forming a highly reactive intermediate cyclic structure that alkylates nucleophiles in the cell structure. This disrupts the normal function of the affected biochemical. Although the actual damage caused by these vesicants occur within minutes of exposure, most clinical effects have a latent period ranging from hours to days. Vesicants affect both exterior and interior parts of the body causing inflammation, blisters, and general destruction of tissues. They have a greater impact on moist areas of the body. Healed burns may be hypersensitive to mechanical trauma.

Eyes are especially susceptible to vesicants. In addition to the immediate corrosive effects, the cornea of the eye can become inflamed (keratitis) after a latency of 6 to 10 years. This condition can progress to blindness. Corneal lesions may reoccur even after receiving a corneal transplantation.

DOI: 10.4324/9781003230571-5

Inhalation of vesicants can cause lung membranes to swell and become filled with liquid (pulmonary edema). Death may result from lack of oxygen.

Vesicants are also systemic agents and readily pass through the skin to affect susceptible tissue including those that produce blood. For this reason, they are often described as radiomimetic poisons. In severe cases systemic effects can include cardiovascular shock and multi-organ failure. Nitrogen vesicants can also cause central nervous system depression and cardiovascular shock. Both sulfur and nitrogen vesicants are carcinogenic.

Pathways and Routes of Exposure

Vesicants are hazardous through any route of exposure including inhalation, skin and eye exposure, ingestion, and broken, abraded, or lacerated skin (e.g., penetration of skin by debris). Thickened agents primarily pose a hazard through skin absorption. Dusty agents are primarily an inhalation hazard but may also cause minor skin/eye impacts. Contact with bulk dusty vesicants can produce more classical blistering and system effects.

General Exposure Hazards

Pure vesicants have little or no odor. However, impurities can give them an easily detectable and identifiable smell. The odor of sulfur vesicants has been described as similar to garlic, horseradish, onions, or mustard. The odor of nitrogen vesicants has been described as fishy, fruity, musty, or even soap-like.

Agent vapors of both series cause eye irritation. However, there is not a significant difference in the concentration that will irritate the eyes and one that will produce eye injury. Although impacts from exposure to vesicants occur almost at once, contact with vapors or the liquid agent neither irritates the skin and nor produces visible dermal injuries until after a substantial latency period. In contrast, HL (C03-A010) – sulfur mustard (C03-A001) mixed with lewisite (C04-A002) – produces immediate pain due to the arsenical vesicant component.

Sulfur series

Lethal concentrations (LC_{50}s) for inhalation of these agents are as low as 11 ppm for a 2-minute exposure.

Lethal percutaneous exposures (LD_{50}s) to liquid are as low as 1.4 grams per individual.

Incapacitating concentrations (ICt_{50}) for dermal exposure to these agents at moderate temperatures (i.e., between 65° and 85°F) are as low as 2 ppm for a 30-minute exposure. Temperatures above 85°F reduce the concentration necessary to produce similar effects.

Eye irritation from exposure to agent vapors occurs at concentrations as low as two ppm after a 2-minute exposure; an incapacitating concentration (ICt_{50}) for exposure of the eyes is as low as 5 ppm for a 2-minute exposure.

Nitrogen series

Lethal concentrations (LC_{50}s) for inhalation of these agents are as low as 60 ppm for a 2-minute exposure.

Lethal percutaneous exposures (LD_{50}s) to liquid are as low as 1.4 grams per individual.

Incapacitating concentrations (ICt_{50}) for dermal exposure to these agents at moderate temperatures (i.e., between 65° and 85°F) are as low as 2 ppm for a 30-minute exposure. Temperatures above 85°F reduce the concentration necessary to produce similar effects.

Eye irritation from exposure to agent vapors occurs at concentrations as low as two ppm after a 2-minute exposure; an incapacitating concentration (ICt_{50}) for exposure of the eyes is as low as 4 ppm for a 2-minute exposure.

The rate of detoxification of vesicants by the body is very low. Exposures are essentially cumulative.

Latency Period

Vapor/Aerosols (mists or dusts)

Eye irritation may become noticeable in a matter of minutes. Other signs and symptoms of exposure, including reddening of the skin (erythema), blistering (vesication), and accumulation of fluid in the lungs (pulmonary edema), do not occur until after a substantial latency period. Mixtures such as HL (C03-A010) contain lewisite (C04-A002) and will produce an immediate burning sensation on contact with the skin or eyes.

Liquids

Tissue damage occurs within minutes of exposure to vesicants, but clinical effects may not appear for up to 24 hours. Mixtures such as HL (C03-A010) contain lewisite (C04-A002) and will produce an immediate burning sensation on contact with the skin or eyes. Some agents are rapidly absorbed through the skin and extensive skin contamination may cause systemic damage.

Solids (non-aerosol)

Tissue damage occurs within minutes of exposure to vesicants, but clinical effects may not appear for up to 24 hours. Some agents are rapidly absorbed through the skin and extensive skin contamination may cause systemic damage.

A key factor affecting the length of time before the onset of symptoms as well as the severity of the symptoms is the part of the body that is exposed to the agent. Apart from mucous membranes, the regions of the body that are the most sensitive to vesicants are warm, moist areas and areas with thin skin such as the face, armpits, inside of the elbow, genitalia, neck, skin between the fingers, and the nail beds. The least susceptible body regions are the palms of the hands, soles feet, front of the knee, and outside of the elbow.

CHARACTERISTICS

Physical Appearance/Odor

Laboratory Grade

Laboratory grade agents are typically colorless oily liquids or solids. They have little or no odor. Salts of nitrogen vesicants are typically white odorless solids. High concentrations of vesicants can cause eye irritation. Because of the lewisite (C04-A002) component, HL (C03-A010) vapors cause immediate irritation to the eyes, nose, throat, and skin.

Munition Grade

Munition grade agents are typically amber to dark brown liquids or solids. As the agent ages and decomposes, it continues to discolor until it may appear black. Production impurities and decomposition products in these agents may give them an odor. The odor of munition grade sulfur vesicants has been described as similar to garlic, horseradish, onions, or mustard; while the odor of munition grade nitrogen vesicants has been described as fishy, fruity, or soapy. Odors may become more pronounced during storage. Nitrogen vesicant agents tend to form crystalline decomposition products that precipitate out of solution on prolonged storage.

Modified Agents

Solvents have been added to vesicants to facilitate handling, stabilize the agents or to increase the ease of percutaneous penetration by the agents. Percutaneous enhancement solvents include dimethyl sulfoxide, N,N-dimethylformamide, N,N-dimethylpalmitamide, N,N-dimethyldecanamide, and saponin. Color and other properties of these solutions may vary from the pure agent. Odors will vary depending on the characteristics of the solvent(s) used and concentration of vesicants in the solution.

Conversely, vesicants have also been thickened with various substances to enhance deployment, increase their persistency, and increase the risk of percutaneous exposure and cross contamination. Thickeners include polyalkyl methacrylates (methyl, ethyl, butyl, isobutyl), polyvinyl acetate, polystyrene, plexiglass, alloprene, polychlorinated isoprene, nitrocellulose, as well as bleached montan and lignite waxes. Military thickener K125 is a mixture of methyl, ethyl, and butyl polymethacrylates. When thickened, agents become sticky with a consistency similar to honey. Typically, not enough thickener is added to affect either the color or odor of the agent.

Vesicants have also been converted to a dusty form by adsorbing the liquid agent onto a solid carrier. Dusty carriers include aerogel, talc, alumina, silica gel, diatomite, kaolinite, fuller's earth, and pumice. Dusty agents appear as finely ground, free-flowing powders with individual particles in the range of 10 microns or less and are dispersed as a particulate cloud. Particles in this range can penetrate clothing and breathable protective gear. Dusty agents pose both an inhalation and contact hazard. Color and other physical properties of dusty agents will depend upon the characteristics of the carrier. Odors may vary from the unmodified agent.

Mixtures with Other Agents

In addition to mixtures containing both sulfur and nitrogen vesicants, individual members of this class have been mixed with other agents such as lewisite (C04-A002) and bis(chloroethyl)ether (C11-A017) to prevent them from freezing in the munition as well as to enhance their toxicity. Details on HL, the standardized sulfur mustard/lewisite mixture, are reported under handbook number C03-A010.

Stability

Crude sulfur vesicants are relatively stable and stability increases with purity. Distilled materials show very little decomposition on storage. Solvents such as carbon tetrachloride and chlorobenzene have been added to enhance stability of crude material. Agents can be stored in glass or steel containers, although pressure may develop in steel containers. Sulfur vesicants rapidly corrode brass and cast iron, and permeate into ordinary rubber.

Nitrogen vesicants are relatively unstable and tend to dimerize or polymerize on storage. Polymerization is accelerated by both heat (as low as 122°F) and light. Polymerizations can be self-accelerating and may generate enough heat to cause an explosion of a sealed container. Polymerization is also accelerated by the presence of polar solvents. Stabilizers, such as carbon disulfide and triphenylcarbinol, may be added to inhibit polymerization. Stabilized agents can be stored in glass or steel containers.

Persistency

For military purposes, unmodified vesicants are classified as persistent. Under proper conditions, agents can remain hazardous in soil and even in water for several years. Limited solubility slows the hydrolysis of liquid agents. Some hydrolysis products are highly toxic and extremely persistent. Evaporation rates range from near that of light machine oil to that of heavy motor oil.

Agents modified with thickeners last significantly longer. Dusty agents can be very persistent depending on the carrier employed and can be re-aerosolized after deployment by ground traffic or strong winds.

Environmental Fate

Vesicant vapors have a density greater than air and tend to collect in low places. Porous material, including painted surfaces, will absorb both liquid and gaseous agent. After the initial surface contamination has been removed, agent that has been absorbed into porous material can migrate

back to the surface posing both a contact and vapor hazard. Clothing may emit trapped agent vapor for up to 30 minutes after contact with a vapor cloud.

Most of these agents are insoluble in water and this limited solubility slows their hydrolysis. On standing, however, aqueous solutions of nitrogen vesicants will decompose forming neurotoxic products. Hydrolysis of agents may be further reduced if they are thickened due to a protective layer that forms at the agent/water interface. Conversely, agent solubility may be increased by solvents. The specific gravities of unmodified liquid agents are much greater than that of water. These agents are soluble in most organic solvents including gasoline, oils, acetone, and alcohols.

ADDITIONAL HAZARDS

Exposure

All foodstuffs in the area of a release should be considered contaminated. Unopened items packaged in glass, metal or heavy-duty plastic and exposed only to agent vapors may be used after decontamination of the container. Unopened items exposed to liquid or solid agents should be decontaminated within a few hours post-exposure or destroyed. Opened or unpackaged items, or those packaged only in paper or cardboard, should be destroyed.

Meat, milk and animal products, including hides, from animals affected or killed by vesicants should be destroyed or quarantined until tested and determined to be safe to use or consume.

Livestock/Pets

Although vesicants do not produce the same type of dermal damage in animals as they do in humans, they are still susceptible to the cytotoxic and systemic toxicities of these agents.

Animals can be decontaminated with shampoo/soap and water, or a 0.5% household bleach solution (i.e., no more than one-part household bleach in nine-parts water). If the animal's eyes have been exposed to agent, they should be irrigated with water or saline solution for a minimum of 30 minutes.

Unprotected feedstock (e.g., hay or grain) should be destroyed. Leaves of forage vegetation could still retain sufficient vesicant agent to produce effects for several weeks post release, depending on the level of contamination and the weather conditions.

Fire

Heat from a fire will increase the amount of agent vapor in the area. A significant amount of the agent could be volatilized and escape into the surrounding environment before it is consumed by the fire. Actions taken to extinguish the fire can also spread the agent. Vesicants may react with steam or water during a fire to produce toxic and/or corrosive gases. In addition, nitrogen vesicants may polymerize due to the heat of the fire. Sealed containers of these agents may present an explosion hazard. HL (C03-A010) contains an arsenic component and combustion or hydrolysis will also produce toxic arsenical decomposition products.

Reactivity

Vesicants are incompatible with strong oxidizers, such as dry HTH or STB, and will spontaneously ignite. Although these agents will decompose if dissolved in water, a lack of solubility inhibits this process. Nitrogen vesicants tend to polymerize on storage, which may generate enough heat to cause an explosion of sealed containers. In addition, the polymerized components may also be an explosion hazard.

Hazardous Decomposition Products

For information on individual impurities and decomposition products, see the decomposition products and impurities section (C03-D) at the end of this chapter.

Hydrolysis

Vesicants produce acidic products including hydrogen chloride (HCl), hydrogen bromide (HBr), or hydrogen fluoride (HF); and ethanolamines, thioglycols, or thioethers. Arsenous oxide decomposition products from HL (C03-A010) are toxic and may also have vesicant properties. HL will also produce acetylene at higher pH.

Combustion

Volatile decomposition products may include hydrogen chloride (HCl), hydrogen bromide (HBr), hydrogen fluoride (HF), as well as nitrogen oxides (NO_x) or sulfur oxides (SO_x). Decomposition vapors from nitrogen vesicants may form explosive mixtures in air. A corrosive and toxic residue may remain after combustion of any of these agents. HL (C03-A010) will also produce toxic arsenic oxides.

PROTECTION

Evacuation Recommendations

Isolation and protective action distances listed below are taken from the *2020 Emergency Response Guidebook.* For vesicants, these recommendations are based on a release scenario involving either a spray or explosively generated mist of vesicant that quickly settles to the ground and soaks in to a depth of no more than 0.25 millimeters. A secondary cloud will then be generated by evaporation of this deposited material. A small release involves 2 kilograms (approximately 1.5 liters of liquid sulfur vesicant and 1.8 liters of liquid nitrogen vesicant) and a large release involves 25 kilograms (approximately 19 liters of liquid sulfur vesicant and 23 liters of liquid nitrogen vesicant).

Because of uncertainties in defining the composition of HL, a mixture of sulfur mustard HD (C03-A001) and lewisite (C04-A002), the evacuation recommendations were based strictly on the lewisite component. A small release of HL involves 2 kilograms (approximately 1.2 liters) of liquid agent and a large release involves 25 kilograms (approximately 15 liters) of liquid agent.

HD (Sulfur Mustard) *C03-A001*

	Initial Isolation	Downwind Day	Downwind Night
Small device (2 kg)	30 m	0.1 km	0.1 km
Large device (25 kg)	60 m	0.3 km	0.4 km

HN1 *C03-A016*

	Initial Isolation	Downwind Day	Downwind Night
Small device (2 kg)	60 m	0.3 km	0.5 km
Large device (25 kg)	200 m	1.1 km	1.8 km

HN2 *C03-A017*

	Initial Isolation	Downwind Day	Downwind Night
Small device (2 kg)	60 m	0.3 km	0.6 km
Large device (25 kg)	300 m	1.3 km	2.1 km

HN3 *C03-A018*

	Initial Isolation	Downwind Day	Downwind Night
Small device (2 kg)	30 m	0.1 km	0.1 km
Large device (25 kg)	60 m	0.3 km	0.3 km

HL (Mustard/Lewisite mixture) *C03-A010*

	Initial Isolation	Downwind Day	Downwind Night
Small device (2 kg)	30 m	0.1 km	0.3 km
Large device (25 kg)	100 m	0.5 km	1.0 km

Personal Protective Requirements

Structural Firefighters' Gear

Structural firefighters' protective clothing is recommended for fire situations only; it is not effective in spill situations or release events and should never be used as the primary chemical protective garment to enter an area contaminated with vesicants.

Respiratory Protection

Self-contained breathing apparatuses (SCBAs) or air purifying respirators (APRs) should have a National Institute for Occupational Safety and Health (NIOSH) Chemical/Biological/Radiological/Nuclear (CBRN) certification since vesicants can degrade the materials used to make some respirators. However, during emergency operations, other NIOSH-approved SCBAs or APRs that have been specifically tested by the manufacturer against chemical warfare agents may be used if deemed necessary by the incident commander. APRs should be equipped with a NIOSH-approved CBRN filter or a combination organic vapor/acid gas/particulate cartridge.

Immediately dangerous to life or health (IDLH) levels are the ceiling limit for respirators other than SCBAs. Any exposures approaching the IDLH level should be regarded with extreme caution and the use of SCBAs for respiratory protection should be considered.

Chemical Protective Clothing

Use only chemical protective clothing that has undergone material and construction performance testing against sulfur and/or nitrogen vesicant agents. Reported permeation rates may be affected by solvents, components or impurities in munition grade or modified agents.

Because of the extreme dermal hazard posed by vesicants, responders should wear a Level A protective ensemble whenever there is a potential for exposure to any solid or liquid agent, or to an elevated or unknown concentration of agent vapor.

Decontamination

General

Sulfur vesicants

These agents are insoluble in water and form self-protecting decomposition products at the water/agent interface that prevent hydrolysis of the agent. These decomposition products are stable and some of them have toxic and/or vesicant properties.

Solubility of an agent will be decreased further if it is dissolved in an immiscible organic solvent or if it is thickened such that it forms a protective layer at the agent/water interface. Addition of solvents or mechanical mixing may be required to overcome insolubility problems.

Once dissolved in water, vesicants are readily destroyed by high pH (i.e., basic solutions), especially when used in combination with a strong oxidizing agent. For this reason, undiluted household bleach is an excellent agent for decontamination of these agents. Ensure that the bleach solution remains in contact with the agent for a minimum of 5 minutes. A large excess will be need to ensure complete destruction of the agents. The lewisite (C04-A002) component of HL (C03-A010) will react with basic solutions, including household bleach, to produce acetylene gas.

Sulfur vesicants are easily oxidized. While initial oxidation produces a sulfoxide, which has no vesicant properties, further oxidation produces a sulfone (e.g., C03-D049, C03-D052, C03-D055), which is nearly as powerful a vesicant as the parent compound. These sulfones are also less reactive than the parent compounds and much more slowly hydrolyzed. A slurry that is 10% by weight of either STB or HTH in water is an effective agent for oxidizing sulfur vesicants. Never use dry STB or HTH as they will react violently with vesicants and may spontaneously ignite. Basic peroxides (e.g., a solution of baking soda, 30–50% hydrogen peroxide and an alcohol) also rapidly detoxify sulfur vesicants. Non-reactive, non-porous materials such as glass can be decontaminated with concentrated nitric acid.

Reactive skin decontaminant lotion (RSDL) containing aqueous solutions of oxime salts, Sandia decontamination foam formulations containing high pH aqueous solutions of hydrogen peroxide, Canadian Aqueous System for Chemical-Biological Agent Decontamination (CASCAD) containing aqueous solutions of chloroisocyanurates and complexing agents, as well as Dahlgren decontamination formulations containing aqueous solutions of peracetyl borate and surfactants are all effective at detoxifying sulfur vesicants.

Nitrogen vesicants

These agents are essentially insoluble in water. They will decompose on standing in water but form neurotoxic products. Some of these toxic decomposition products can last for extended periods.

Solubility of an agent will be decreased further if it is dissolved in an immiscible organic solvent or if it is thickened such that it forms a protective layer at the agent/water interface. The addition of solvents or mechanical mixing may be required to overcome insolubility problems.

Once dissolved in water, vesicants are readily destroyed by high pH (i.e., basic solutions), especially when used in combination with a strong oxidizing agent. For this reason, undiluted household bleach is an excellent agent for decontamination of these agents. Ensure that the bleach solution remains in contact with the agent for a minimum of 5 minutes. A large excess will be need to ensure complete destruction of the agents.

Nitrogen vesicants are easily oxidized. However, incomplete oxidation produces the N-oxide, which are still highly toxic and relatively stable. A slurry that is ten percent by weight of either STB or HTH in water is an effective agent for oxidizing nitrogen vesicants. Never use dry STB or HTH as they will react violently with vesicants and may spontaneously ignite. Basic peroxides (e.g., a solution of baking soda, 30–50% hydrogen peroxide and an alcohol) also rapidly detoxify nitrogen vesicants.

Although specific data has not been published in the unclassified literature, preliminary studies indicate that reactive oximes and their salts, such as potassium 2,3-butanedione monoximate found in commercially available reactive skin decontaminant lotion (RSDL), are extremely effective at rapidly detoxifying nitrogen vesicants.

Vapors

Casualties/Personnel

Speed in decontamination is absolutely essential. To be effective, decontamination must be completed within 2 minutes post-exposure. However, decontamination after the initial 2 minutes should still be undertaken in order to prevent additional percutaneous absorption of the agent leading to systemic toxicity. Remove all clothing as it may continue to emit trapped agent vapor after contact with the vapor cloud has ceased. Shower using copious amounts of soap and water. Ideally, showers will be high volume with low pressure. Ensure that the hair has been washed and rinsed to remove potentially trapped vapor. If there is a potential that the eyes have been exposed to vesicants, irrigate with water or 0.9% saline solution for a minimum of 15 minutes.

Small areas

Ventilate to remove the vapors. If condensation is present, decontaminate with copious amounts of undiluted household bleach (see general section above). Allow it to stand for a minimum of 5 minutes before rinsing with water. Collect and place into containers lined with high-density polyethylene. Removal of porous material, including painted surfaces, may be required because vesicants that have been absorbed into these materials can migrate back to the surface posing both a contact and vapor hazard.

Liquids, Solutions, or Liquid Aerosols

Casualties/Personnel

Cover all open wounds during the decontamination process. Speed in decontamination is absolutely essential. To be effective, decontamination must be completed within 2 minutes after exposure. However, decontamination after the initial 2minutes should still be undertaken in order to prevent to prevent additional percutaneous absorption of the agent leading to systemic toxicity. Remove all clothing immediately. Even clothing that has not come into direct contact with the agent may contain trapped vapor. To avoid further exposure of the head, neck and face to the agent, cut off potentially contaminated clothing that must be pulled over the head. Remove as much of the vesicant from the skin as fast as possible. If water is not immediately available, the agent can be absorbed with any convenient material such as paper towels, toilet paper, flour, or talc. To minimize both spreading the agent and abrading the skin, do not rub the agent with the absorbent. Blot the contaminated skin with the absorbent.

Use a sponge or cloth with liquid soap and copious amounts of water to wash the skin surface and hair at least three times. Ideally, showers will be high-volume with low-pressure. Do not delay decontamination to find warm or hot water if it is not readily available. Avoid rough scrubbing as this could abrade the skin and increase percutaneous absorption of residual agent. Rinse with copious amounts of water. If there is a potential that the eyes have been exposed to vesicants, irrigate with water or 0.9% saline solution for a minimum of 15 minutes.

Although the CDC does not recommend the use of hypochlorite bleach directly on skin for decontamination, the military still recognizes household bleach as an effective alternative to soap and water. The bleach solution should be no more than 0.5% sodium hypochlorite (i.e., no more than one-part household bleach in nine parts water) to avoid damaging the skin. Avoid any contact with sensitive areas such as the eyes. Rinse with copious amounts of water.

Small areas

Ventilate to remove the aerosol. Puddles of liquid can be contained by covering with absorbent material such as vermiculite, diatomaceous earth, clay, sponges, or towels. Place the absorbed material into containers lined with high-density polyethylene. Before sealing the container, cover the contents with undiluted household bleach or an HTH/water slurry (see general section above). If HL (C03-A010) is involved, then flammable acetylene gas will be generated during the

neutralization process. Take appropriate actions to disperse the vapors. Decontaminate the area with copious amounts of the neutralizing agent. Ensure that it remains in contact with the agent for a minimum of 5minutes before rinsing with water. Collect and containerize the rinseate. Ventilate the area to remove residual vapors. Removal of porous material, including painted surfaces, may be required because vesicants that have been absorbed into these materials can migrate back to the surface posing both a contact and vapor hazard.

Solids, Dusty Agents, or Particulate Aerosols

Casualties/Personnel

Cover all open wounds during the decontamination process. Speed in decontamination is absolutely essential. To be effective, decontamination must be completed within 2 minutes post-exposure. Do not attempt to brush the agent off of the individual or their clothing as this can aerosolized the agent. If possible, dampen the agent with a water mist to help prevent aerosolization. Remove all clothing immediately. To avoid further exposure of the head, neck and face to the agent, cut off potentially contaminated clothing that must be pulled over the head. Wash the skin surface and hair at least three times with copious amounts of soap and water. Ideally, showers will be high volume with low pressure. Do not delay decontamination to find warm or hot water if it is not readily available. Rinse with copious amounts of water. If there is a potential that the eyes have been exposed to vesicants, irrigate with water or 0.9% saline solution for a minimum of 15 minutes.

Small areas

If indoors, close windows and doors in the area and turn off anything that could create air currents (e.g., fans, air conditioner, etc.). Allow aerosol to settle. Avoid actions that could aerosolize the agent such as sweeping or brushing. Collected the agent using a vacuum cleaner equipped with a high-efficiency particulate air (HEPA) filter. Do not use a standard home or industrial vacuum. Do not allow the vacuum exhaust to stir the air in the affected area. Vacuum all surfaces with extreme care in a very slow and controlled manner to minimize aerosolizing the agent. Place the collected material into containers lined with high-density polyethylene. Before sealing the container, cover the contents with undiluted household bleach or the HTH/water slurry (see general section above). Decontaminate the area with copious amounts of the neutralizing agent. Ensure that it remains in contact with the agent for a minimum of 5minutes before rinsing with water. Collect and containerize the rinseate.

MEDICAL

CDC Case Definition

1) A case in which a sulfur or nitrogen vesicant is detected in biologic samples. OR 2) Detection of vesicants in environmental samples. The case can be confirmed if laboratory testing is not performed by either the presence of a predominant amount of clinical and nonspecific laboratory evidence or an absolute certainty of the etiology of the agent.

Differential Diagnosis

The following factors have been suggested as alternatives to consider when presented with a potential case of exposure to vesicant agents: chemical burns from contact with strong acids or bases; barbiturates, chemotherapeutic agents, carbon monoxide; reactions to drugs producing Stevens-Johnson syndrome and/or toxic epidermal necrolysis; autoimmune diseases such as bullous pemphigoid and pemphigus vulgaris; and staphylococcus scalded skin syndrome.

Signs and Symptoms

Vapors/Aerosols

Feeling of irritation and grittiness in the eyes are generally the first indications of exposure. These symptoms usually occur 30 minutes to 3 hours post-exposure and, depending on the amount of agent involved, progress to soreness with a bloodshot appearance. These symptoms can be followed by swelling, pain, tearing, involuntary blinking (blepharospasm), and sensitivity to light (photophobia). Eye symptoms may be accompanied by an increase in nasal secretion, sneezing, sore throat, coughing and hoarseness. Individuals who have been exposed to a large amount of agent may experience nausea, retching, and vomiting.

There is an asymptomatic latent period, usually 4 to 24 hours, before skin impacts appear. With minimal exposure, skin impacts may be limited to reddening of the skin (erythema). Otherwise, progresses to large blisters typically filled with a clear yellow fluid. Blisters do not contain active vesicant agent. These blisters usually break leaving the skin open to secondary infection. Blistering from a vapor-only exposure is generally comparable to a first-degree or second-degree burn. The skin may darken on and around the burned area.

If HL (C03-A010) is involved, then exposure of the eyes to even small amounts of vapor will produce immediate tearing, pain and involuntary blinking (blepharospasm). Eye symptoms are rapidly followed by coughing, sneezing and vomiting. Exposure of the skin to HL produces an immediate burning sensation. Reddening of the skin (erythema) may appear in as short a time as 5minutes although full progression to blisters may not develop for up to 18 hours.

Liquids/Solids

There is an asymptomatic latent period, usually 4 to 24 hours, before skin impacts appear. With minimal exposure, skin impacts may be limited to reddening of the skin (erythema). Otherwise, erythema progresses to large blisters typically filled with a clear yellow fluid or further to lesions with a central zone of localized death of cells or tissues (necrosis) and peripheral blisters. Blisters do not contain active vesicant agent. Blisters are easy to break leaving the skin open to secondary infection. Blistering from a liquid exposure can produce deep damage comparable to a third-degree burn. The skin may darken on and around the burned area.

If HL (C03-A010) is involved, then exposure of the skin will produce an immediate burning sensation, which may be quickly follow by reddening of the skin (erythema). In addition to other latent effects, casualties exposed to HL may also develop signs of systemic arsenic toxicity including diarrhea, damage to the liver, kidneys, nervous system, and the brain.

Mass-Casualty Triage Recommendations

Priority 1

A casualty with mild to moderate pulmonary effects less than 6 hours post-exposure, or a casualty with moderately severe or severe pulmonary signs and symptoms after 6 hours post-exposure.

Priority 2 (majority of cases)

A casualty with skin lesions covering between 5 and 50% of the body surface area (BSA), a casualty with mild to moderate pulmonary effects after 6 hours post-exposure, or a casualty with eye injuries.

Priority 3

A casualty with skin lesions covering less than 5% of the BSA, or a casualty with eye irritation or reddening, and/or slight upper respiratory complaints such as hacking cough or irritated throat 12 or more hours post-exposure.

Priority 4

A casualty with skin lesions from *liquid exposure* to more than 50% of the BSA, or a casualty with severe pulmonary effects less than 6hours post-exposure.

Casualty Management

Decontaminate the casualty ensuring that all the vesicant has been removed. Rapid decontamination of any exposure is essential. If vesicants have gotten into the eyes, irrigate the eyes with water or 0.9% saline solution for at least 15 minutes. Irrigate open wounds with water or 0.9% saline solution for at least 10 minutes.

Once the casualty has been decontaminated, including the removal of foreign matter from wounds, medical personnel do not need to wear a chemical-protective mask.

There is no antidote for exposure to these agents. Treatment consists of symptomatic management of lesions. If a casualty is known to have inhaled vesicant vapors but does not display any signs or symptoms of an impacted airway, it may still be appropriate to intubate the casualty since laryngeal spasms or edema may make it difficult or impossible later. Eye lesions should be treated by saline irrigation and coating the follicular margins with petroleum jelly to prevent sticking.

If HL (C03-A010) is involved, a BAL (British-anti-Lewisite, dimercaprol) solution or ophthalmic ointment may be beneficial if administered promptly. It may also decrease the severity of skin and eye lesions if applied topically within minutes after decontamination is complete (i.e., within 2 to 5 minutes post-exposure).

Asymptomatic individuals suspected of exposure to vesicants should be kept under observation for at least 8 hours.

Burns from *liquid exposure* to over 50% of the body surface suggests that the individual has absorbed twice a lethal dose of vesicant and the prognosis for survival of the individual is poor.

FATALITY MANAGEMENT

Remove all clothing and personal effects segregating them as either durable or non-durable items. While it may be possible to decontaminate durable items, it may be safer and more efficient to destroy non-durable items rather than attempt to decontaminate them. Items that will be retained for further processing should be double sealed in impermeable containers, ensuring that the inner container is decontaminated before placing it in the outer one.

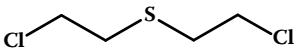
Vesicants that have entered the body are metabolized, hydrolyzed, or bound to tissue and pose little threat of off-gassing. To remove agents on the outside of the body, wear appropriate respiratory and dermal protective clothing while washing the remains with a 2% sodium hypochlorite bleach solution (i.e., 2 liters of water for every liter of household bleach), ensuring the solution is introduced into the ears, nostrils, mouth, and any wounds. This concentration of bleach will not affect remains but will neutralize vesicant agents. Higher concentrations of bleach can harm remains. Pay particular attention to areas where agent may get trapped, such as hair, scalp, pubic areas, fingernails, folds of skin, and wounds. The bleach solution should remain on the cadaver for a minimum of 15 minutes. Wash with soap and water. Ensure that all the bleach solution is removed prior to embalming as it will react with embalming fluid. All wash and rinse waste must be contained for proper disposal. Screen the remains for agent vapors and residual liquid at the conclusion of the decontamination process. If the remains must be stored before embalming, then place them inside body bags designed to contain contaminated bodies or in two body bags. If two body bags are used, seal the inner bag with duct tape, rinse, then place in the second bag. After embalming is complete, place the remains in body bags designed to contain contaminated bodies or in two body bags. Body fluids removed during the embalming process do not pose any additional risks and should be contained and handled according to established procedures.

Standard burials are acceptable when contamination levels are low enough to allow bodies to be handled without wearing additional protective equipment. Cremation may be required if remains cannot be completely decontaminated. Although vesicant agents are destroyed at the operating temperature of a commercial crematorium (i.e., above 1,000°F), the initial heating phase may volatilize some of the agent and allow vapors to escape. Additionally, if HL (C03-A010) is involved then combustion will produce toxic and potentially volatile arsenic oxides.

C03-A SULFUR VESICANTS

C03-A001

Mustard Gas (Agent HD)
CAS: 505-60-2
RTECS: WQ090000
UN: —
EC: —
UNII: T8KEC9FH9P
ICD-11: XM16X6



$C_4\ H_8\ S\ Cl_2$

Oily, colorless to amber to dark brown liquid. Yellow solid below 58°F. Pure material is odorless; otherwise has an odor similar to garlic or horseradish that is detectable at ≥0.1 ppm.

This material is on Schedule 1 of the CWC.

Also reported as a mixture with sesquimustard (C03-A002); O-mustard (C03-A003); HN1 (C03-A016); HN3 (C03-A018); lewisite (C04-A002); and phenyldichloroarsine (C04-A004).

Exposure Hazards
Conversion Factor: 1 ppm = 6.51 mg/m^3 at 77°F
$LCt_{50\ (Inh)}$: 1,000 mg-min/m^3 (80 ppm for a 2-minute exposure)
$LCt_{50\ (Per)}$: *<85°F:* 10,000 mg-min/m^3 (50 ppm for a 30-minute exposure)
$LCt_{50\ (Per)}$: *>85°F:* 5,000 mg-min/m^3 (30 ppm for a 30-minute exposure)
LD_{50}: 1.4 g
$ICt_{50\ (Skin)}$: *<85°F:* 500 mg-min/m^3 (3 ppm for a 30-minute exposure)
$ICt_{50\ (Skin)}$: *>85°F:* 200 mg-min/m^3 (1 ppm for a 30-minute exposure)
$ICt_{50\ (Eyes)}$: 75 mg-min/m^3 (6 ppm for a 2-minute exposure)
Eye Irritation: 2 ppm for a 2-minute exposure
$MEG_{(1hr)}$: Neg: 0.010 ppm; Mar: 0.029 ppm; Crit: 0.065 ppm; Cat: 0.26 ppm
PAC-1: 0.010 ppm; *PAC-2:* 0.020 ppm; *PAC-3:* 0.32 ppm
WPL AEL: 6×10^{-5} ppm
GPL AEL: 3×10^{-6} ppm
$STEL_{(CDC)}$: 5×10^{-4} ppm
IDLH: 0.1 ppm

Final AEGLs
AEGL-1: 1 hr – 0.010 ppm; 4 hr – 0.0030 ppm; 8 hr – 0.0010 ppm
AEGL-2: 1 hr – 0.020 ppm; 4 hr – 0.0040 ppm; 8 hr – 0.0020 ppm
AEGL-3: 1 hr – 0.32 ppm; 4 hr – 0.080 ppm; 8 hr – 0.040 ppm

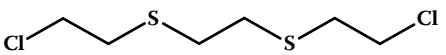
Properties:

MW: 159.1	*VP:* 0.11 mmHg (77°F)	*FlP:* 221°F
D: 1.3 g/mL (77°F)	*VD:* 5.5	*LEL:* —
MP: 58°F	*Vlt:* 141 ppm (77°F)	*UEL*: —
BP: Decomposes	*ER:* —	*RP:* 73
Vsc: 4.0 cS (77°F)	H2O: 0.068% (77°F)	*IP:* <9 eV
	Sol: Hydrocarbons, acetone, alcohols	

Solid	**Thickened**
D: 1.33 g/cm^3 (50°F)	*Vsc:* 1,000–1,200 cS

C03-A002

Sesquimustard (Agent Q)
CAS: 3563-36-8
RTECS: —
UN: —
EC: —
UNII: 5Y1NV229PO
ICD-11: —



$C_6 H_{12} Cl_2 S_2$

Pale amber solid. Pure material has little or no odor; otherwise has an odor similar to garlic or horseradish. Also found as an impurity in sulfur mustard (C03-A001).

This material is on Schedule 1 of the CWC.

Also reported as a mixture with sulfur mustard (C03-A001).

Exposure Hazards

Conversion Factor: 1 ppm = 8.97 mg/m^3 at 77°F
$LCt_{50\ (Inh)}$: 200 mg-min/m^3 (11 ppm for a 2-minute exposure)
$ICt_{50\ (Skin)}$: 300 mg-min/m^3 (1 ppm for a 30-minute exposure)

These values are from older sources (circa 1956). Reevaluation and updates of toxicity values for similar agents suggest Q may be more toxic than the values reported here.

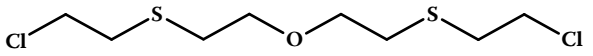
$MEG_{(1hr)}$: Neg: 0.017 ppm; Mar: 0.14 ppm; Crit: 0.67 ppm; Cat: —
PAC-1: 0.010 ppm; *PAC-2:* 0.020 ppm; *PAC-3:* 0.32 ppm

Properties:

MW: 219.2	*VP:* 3.5×10^{-5} mmHg (77°F)	*FlP:* —
D: 1.3 g/cm^3 (77°F)	*VD:* 7.6	*LEL:* —
MP: 133°F	*Vlt:* —	*UEL*: —
BP: Decomposes	*ER:* —	*RP:* 200,000
Vsc: —	H_2O: 0.0025%	*IP:* —
	Sol: Hydrocarbons, acetone, alcohols	

C03-A003

O-Mustard (Agent T)
CAS: 63918-89-8
RTECS: WQ3250000
UN: —
EC: —
UNII: —
ICD-11: —



$C_8\ H_{16}\ Cl_2\ O\ S_2$

Yellow liquid. Pure material has little or no odor; otherwise has an odor similar to garlic or horseradish.

This material is on Schedule 1 of the CWC.

Also reported as a mixture sulfur mustard (C03-A001). In addition, it is also found as a natural aging impurity in sulfur mustard.

Exposure Hazards
Conversion Factor: 1 ppm = 10.77 mg/m^3 at 77°F
$ICt_{50\ (Skin)}$: 400 mg-min/m^3 (1 ppm for a 30-minute exposure).

This value is from older sources (circa 1956). Reevaluation and updates of toxicity values for similar agents suggest T may be more toxic than the values reported here.

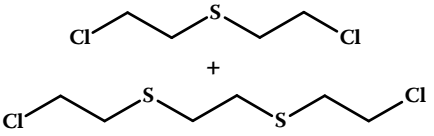
$MEG_{(1hr)}$: Neg: 0.75 mg/m^3; Mar: 6.0 mg/m^3; Crit: 30 mg/m^3; Cat: —
PAC-1: 0.12 mg/m^3; *PAC-2:* 1.3 mg/m^3; *PAC-3:* 7.6 mg/m^3

Properties:

MW: 263.3	*VP:* 3×10^{-5} mmHg (77°F)	*FlP:* —
D: 1.2 g/mL (77°F)	*VD:* 9.1	*LEL:* —
MP: 49°F	*Vlt:* 0.04 ppm (77°F)	*UEL*: —
BP: Decomposes	*ER:* —	*RP:* 100,000
Vsc: 15 cS (77°F)	H_2O: Insoluble	*IP:* —
	Sol: —	

C03-A004

Mustard/Sesquimustard Mixture (Agent HQ)
CAS: —
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



Oily, colorless to amber to dark brown liquid. Pure material is odorless; otherwise has an odor similar to garlic or horseradish. Typical mixture is 75% sulfur mustard (C03-A001) and 25% sesquimustard (C03-A002).

This material is on Schedule 1 of the CWC.

Exposure Hazards

Human toxicity values have not been established or have not been published. However, the agents in this mixture are extremely powerful vesicants and highly toxic by inhalation.

Properties:

MW: Mixture	*VP:* 0.09 mmHg (77°F) (est.)	*FlP:* —
D: —	*VD:* 6.0	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: Decomposes	*ER:* —	*RP:* 200,000
Vsc: —	H_2O: Insoluble	*IP:* —
	Sol: Hydrocarbons; acetone; alcohols	

C03-A005

Sulfur Mustard/O-Mustard Mixture (Agent HT)

CAS: 172672-28-5

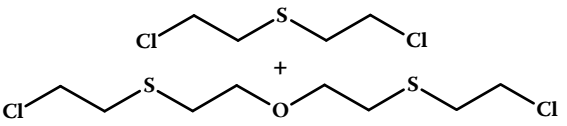
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



Clear, yellow to brown highly viscous liquid. Pure material is odorless; otherwise has an odor similar to garlic or horseradish. Odor is less pronounced than with sulfur mustard alone. Typical mixture is 60% sulfur mustard (C03-A001) and 40% O-Mustard (C03-A003).

This material is on Schedule 1 of the CWC.

Exposure Hazards

$LCt_{50\ (Inh)}$: 1,000 mg-min/m^3 (60 ppm for a 2-minute exposure)

$LCt_{50\ (Per)}$: 10,000 mg-min/m^3 (40 ppm for a 30-minute exposure)

LD_{50}: 1.4 g

$ICt_{50\ (Skin)}$: *<85°F:* 500 mg-min/m^3 (2 ppm for a 30-minute exposure)

$ICt_{50\ (Skin)}$: *>85°F:* 200 mg-min/m^3 (0.9 ppm for a 30-minute exposure)

$ICt_{50\ (Eyes)}$: 75 mg-min/m^3 (5 ppm for a 2-minute exposure)

Eye Irritation: 2 ppm for a 2-minutes exposure

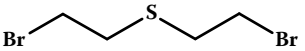
WPL AEL: 6×10^{-5} ppm
GPL AEL: 3×10^{-6} ppm
$STEL_{(CDC)}$: 5×10^{-4} ppm
IDLH: 0.1 ppm

Properties:

MW: Mixture	*VP:* 0.077 mmHg (77°F)	*FlP:* 228°F
D: 1.3 g/mL (77°F)	*VD:* 6.5	*LEL:* —
MP: 32°F	*Vlt:* —	*UEL:* —
BP: Decomposes	*ER:* —	*RP:* —
Vsc: —	H_2O: Slight	*IP:* —
	Sol: Most organic solvents	

C03-A006

Dibromoethyl Sulfide (Bromlost)
CAS: 7617-64-3
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_4 H_8 Br_2 S$

White crystalline solid. More susceptible to hydrolysis than sulfur mustard (C03-A001).

Exposure Hazards

Conversion Factor: 1 ppm = 10.14 mg/m^3 at 77°F
$LC_{50\ (Inh)}$: 1,000 mg/m^3 (99 ppm) for a 10-minute exposure

This value is from older sources (circa 1937). No updated toxicity estimates have been proposed.

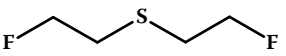
Properties:

MW: 248.0	*VP:* —	*FlP:* —
D: 2.1 g/cm^3	*VD:* 8.6	*LEL:* —
MP: 70°F	*Vlt:* 39 ppm	*UEL:* —
BP: Decomposes	*ER:* —	*RP:* —
Vsc: —	H_2O: —	*IP:* —
	Sol: —	

C03-A007

Difluorodiethyl Sulfide (Fluorlost)
CAS: 373-25-1
RTECS: —
UN: —
EC: —
UNII: —

ICD-11: —



$C_4 H_8 F_2 S$

Specific information on physical appearance is not available for this agent.

Exposure Hazards

Conversion Factor: 1 ppm = 5.16 mg/m^3 at 77°F

Based on available information, this material appears to have few, if any, acute vesicant or other toxicologically significant properties.

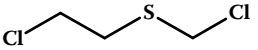
Properties:

MW: 126.2	*VP:* —	*FlP:* —
D: —	*VD:* 4.4	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 203°F (30 mmHg)	*ER:* —	*RP:* —
Vsc: —	H_2O: —	*IP:* —
	Sol: —	

C03-A008

2-Chloroethylchloromethylsulfide

CAS: 2625-76-5
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_3 H_6 Cl_2 S$

Specific information on physical appearance is not available for this agent.

This material is on Schedule 1 of the CWC.

Exposure Hazards

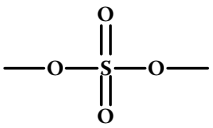
Conversion Factor: 1 ppm = 5.93 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.010 ppm; Mar: 0.017 ppm; Crit: 0.25 ppm; Cat: —
PAC-1: 0.0099 ppm; *PAC-2:* 0.020 ppm; *PAC-3:* 0.32 ppm

Properties:

MW: 145.1	*VP:* —	*FlP:* —
D: —	*VD:* 5.0	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 165°F (18 mmHg)	*ER:* —	*RP:* —
Vsc: —	H_2O: —	*IP:* <9 eV
	Sol: —	

C03-A009

Dimethyl Sulfate (D-Stoff)
CAS: 77-78-1
RTECS: WS8225000
UN: 1595; 156
EC: 201-058-1
UNII: JW5CW40Z50
ICD-11: XM71L2; XM8TX4 (fumes)



C_2 H_6 O_4 S

Colorless, oily liquid with a faint odor like onions. Vapors rapidly react with moisture in the air to produce methanol and sulfuric acid.

Also reported as a mixture with chlorosulfonic acid; methyl chlorosulfonate (C10-A009).

This material is on the Australia Chemicals of Security Concern list and ITF-25 Low Threat list.

Exposure Hazards
Conversion Factor: 1 ppm = 5.16 mg/m^3 at 77°F
$LCt_{50\ (Inh)}$: 500 mg/m^3 (97 ppm) for a 10-minute exposure
Eye Irritation: 1 ppm; exposure duration unspecified
$MEG_{(1hr)}$: Neg: 0.023 ppm; Mar: 0.12 ppm; Crit: 1.6 ppm; Cat: —
PAC-1: 0.023 ppm; *PAC-2:* 0.12 ppm; *PAC-3:* 1.6 ppm
PEL: 1 ppm [Skin]
REL: 0.1 ppm [Skin]
TLV: 0.1 ppm [Skin]
IDLH: 7 ppm

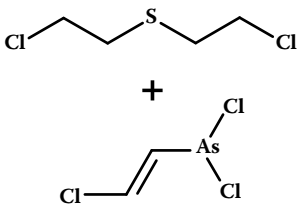
Interim AEGLs
AEGL-1: 1 hr – 0.024 ppm; 4 hr – 0.012 ppm; 8 hr – 0.0087 ppm
AEGL-2: 1 hr – 0.12 ppm; 4 hr – 0.061 ppm; 8 hr – 0.043 ppm
AEGL-3: 1 hr – 1.6 ppm; 4 hr – 0.82 ppm; 8 hr – 0.58 ppm

Properties:

MW: 126.1	*VP:* 0.1 mmHg	*FlP:* 182°F
D: 1.3 g/mL	*VD:* 4.3	*LEL:* 3.6%
MP: -25°F	*Vlt:* 890 ppm (77°F)	*UEL*: 23.3%
BP: 370°F; Decomposes	*ER:* —	*RP:* 88
Vsc: —	H_2O: 3%; Decomposes >64°F	*IP:* —
	Sol: Ethanol, ether, acetone, aromatic hydrocarbons	

C03-A010

Mustard Lewisite Mixture (Agent HL)
CAS: 378791-32-3
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



Oily, colorless to brownish liquid with an odor like garlic. Mixture consists of 37 to 50% sulfur mustard (C03-A001) and 63 to 50% lewisite (C04-A002). The eutectic mixture is 37% sulfur mustard and 63% lewisite.

This material is on Schedule 1 of the CWC.

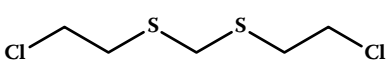
Exposure Hazards
Provisional exposure values have been published for this mixture. However, they are based solely on, and are identical to, the sulfur mustard component (see C03-A001). These updates have not been formally adopted.

Properties for eutectic mixture:

MW: Mixture	*VP:* 0.25 mmHg (est.)	*FlP:* 193°F (est.)
D: —	*VD:* 6.5	*LEL:* —
MP: -14°F	*Vlt:* —	*UEL:* —
BP: <374°F	*ER:* —	*RP:* 30 (est.)
Vsc: 1.6 cS (est.)	H_2O: —	*IP:* —
	Sol: —	

C03-A011

Bis(2-Chloroethylthio)methane
CAS: 63869-13-6
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_5\ H_{10}\ Cl_2\ S_2$

Specific information is not available for this material.

This material is on Schedule 1 of the CWC.

Exposure Hazards

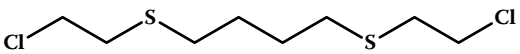
Conversion Factor: 1 ppm = 8.39 mg/m^3 at 77°F
MEG$_{(1hr)}$: Neg: 0.15 mg/m^3; Mar: 1.0 mg/m^3; Crit: 5.0 mg/m^3; Cat: —
PAC-1: 0.80 mg/m^3; *PAC-2:* 0.17 mg/m^3; *PAC-3:* 2.7 mg/m^3

Properties:

MW: 205.2	*VP:* 0.38 mmHg (est.)	*FlP:* 266°F
D: 1.2 g/mL (est.)	*VD:* 7.1	*LEL:* —
MP: 65°F (est.)	*Vlt:* —	*UEL*: —
BP: 571°F	*ER:* —	*RP:* —
Vsc: —	H_2O: —	*IP:* <9 eV
	Sol: —	

C03-A012

1,4-Bis(2-Chloroethylthio)-n-butane
CAS: 142868-93-7
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_8\ H_{16}\ Cl_2\ S_2$

Specific information is not available for this material.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Conversion Factor: 1 ppm = 10.11 mg/m^3 at 77°F
MEG$_{(1hr)}$: Neg: 0.20 mg/m^3; Mar: 1.3 mg/m^3; Crit: 6.0 mg/m^3; Cat: —
PAC-1: 0.10 mg/m^3; *PAC-2:* 0.20 mg/m^3; *PAC-3:* 3.2 mg/m^3

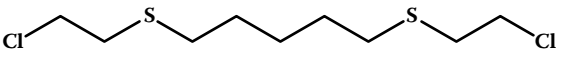
Properties:

MW: 247.3	*VP:* 1.29 × 19^{-4} mmHg (77°F)	*FlP:* 308°F
D: 1.2 g/mL (est.)	*VD:* 8.5	*LEL:* —
MP: 61°F (est.)	*Vlt:* 0.17 ppm (77°F)	*UEL*: —
BP: 652°F	*ER:* —	*RP:* 50,000
Vsc: —	H_2O: Insoluble	*IP:* <9 eV
	Sol: —	

C03-A013

1,5-Bis(2-chloroethylthio)-n-pentane
CAS: 142868-94-8
RTECS: —
UN: —

EC: —
UNII: —
ICD-11: —



$C_9\ H_{18}\ Cl_2\ S_2$

Specific information is not available for this material.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Conversion Factor: 1 ppm = 10.69 mg/m^3 at 77°F
MEG$_{(1hr)}$: Neg: 0.20 mg/m^3; Mar: 1.5 mg/m^3; Crit: 7.5 mg/m^3; Cat: —
PAC-1: 0.11 mg/m^3; *PAC-2:* 0.21 mg/m^3; *PAC-3:* 3.4 mg/m^3

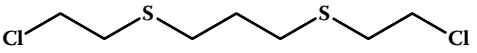
Properties:

MW: 261.3	*VP:* 0.0021 mmHg (est.)	*FlP:* 321°F
D: 1.1 g/mL	*VD:* 9.0	*LEL:* —
MP: 72°F (est.)	*Vlt:* —	*UEL*: —
BP: 678°F	*ER:* —	*RP:* —
Vsc: —	H_2O: Insoluble	*IP:* <9 eV
	Sol: —	

C03-A014

1,3-Bis(2-Chloroethylthio)-n-propane

CAS: 63905-10-2
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_7\ H_{14}\ Cl_2\ S_2$

Specific information is not available for this material.

This material is on Schedule 1 of the CWC.

Exposure Hazards

Conversion Factor: 1 ppm = 9.54 mg/m^3 at 77°F
MEG$_{(1hr)}$: Neg: 0.15 mg/m^3; Mar: 1.3 mg/m^3; Crit: 6.0 mg/m^3; Cat: —
PAC-1: 0.10 mg/m^3; *PAC-2:* 0.19 mg/m^3; *PAC-3:* 3.0 mg/m^3

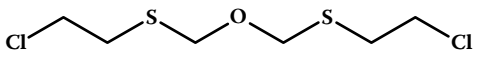
Properties:

MW: 233.2	*VP:* —	*FlP:* —
D: 1.2 g/mL	*VD:* 8.0	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 644°F	*ER:* —	*RP:* —
Vsc: —	H_2O: —	*IP:* <9 eV

Sol: —

C03-A015

Bis(2-chloroethylthiomethyl)ether
CAS: 63918-90-1
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_6 H_{12} Cl_2 O S_2$

Specific information is not available for this material.

This material is on Schedule 1 of the CWC.

Exposure Hazards
Conversion Factor: 1 ppm = 9.62 mg/m^3 at 77°F
MEG$_{(1hr)}$: Neg: 0.15 mg/m^3; Mar: 1.3 mg/m^3; Crit: 6.0 mg/m^3; Cat: —
PAC-1: 0.10 mg/m^3; *PAC-2:* 0.20 mg/m^3; *PAC-3:* 3.1 mg/m^3

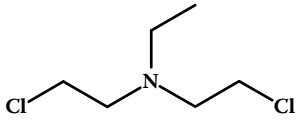
Properties:

MW: 235.2	*VP:* 0.01 mmHg (est.)	*FlP:* 264°F (est.)
D: 1.2 g/mL (est.)	*VD:* 8.1	*LEL:* —
MP: 55°F (est.)	*Vlt:* —	*UEL*: —
BP: 545°F (est.)	*ER:* —	*RP:* —
Vsc: —	H_2O: 0.1% (est.)	*IP:* <9 eV
	Sol: —	

NITROGEN VESICANTS

C03-A016

Nitrogen Mustard 1 (Agent HN1)
CAS: 538-07-8
RTECS: YE1225000
UN: —
EC: —
UNII: B75ZZA7WIG
ICD-11: —



$C_8 H_{13} Cl_2 N$

Oily, colorless to amber liquid with a faint fishy or musty odor. Salts are odorless white solids.

Also reported as a mixture with sulfur mustard (C03-A001).

Exposure Hazards

Conversion Factor: 1 ppm = 6.96 mg/m^3 at 77°F
$LCt_{50\ (Inh)}$: 1,000 mg-min/m^3 (72 ppm for a 2-minute exposure)
$LCt_{50\ (Per)}$: <85°F: 10,000 mg-min/m^3 (48 ppm for a 30-minute exposure)
$LCt_{50\ (Per)}$: >85°F: 5,000 mg-min/m^3 (24 ppm for a 30-minute exposure)
LD_{50}: 1.4 g
$ICt_{50\ (Skin)}$: <85°F: 500 mg-min/m^3 (2.4 ppm for a 30-minute exposure)
$ICt_{50\ (Skin)}$: >85°F: 200 mg-min/m^3 (1 ppm for a 30-minute exposure)
$ICt_{50\ (Eyes)}$: 75 mg-min/m^3 (5.4 ppm for a 2-minute exposure)
Eye Irritation: 3.5 ppm for a 2-minutes exposure
Skin Irritation: 0.2 ppm for a 2-minutes exposure
$MEG_{(1hr)}$: Neg: 0.0019 ppm; Mar: 0.0031 ppm; Crit: 0.053 ppm; Cat: —
PAC-1: 0.00029 ppm; *PAC-2:* 0.0032 ppm; *PAC-3:* 0.053 ppm

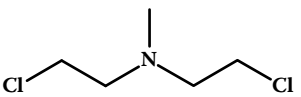
Interim AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 0.0031 ppm; 4 hr – 0.00080 ppm; 8 hr – 0.00040 ppm
AEGL-3: 1 hr – 0.053 ppm; 4 hr – 0.013 ppm; 8 hr – 0.0068 ppm

Properties:

MW: 170.1	*VP:* 0.244 mmHg (77°F)	*FlP:* —
D: 1.1 g/mL (77°F)	*VD:* 5.9	*LEL:* —
MP: -30°F	*Vlt:* 320 ppm	*UEL*: —
BP: Decomposes	*ER:* —	*RP:* 32
Vsc: —	H_2O: 0.4%	*IP:* —
	Sol: Most organic solvents	

C03-A017

Nitrogen Mustard 2 (Agent HN2)
CAS: 51-75-2; 55-86-7 (Hydrochloride salt)
RTECS: IA1750000
UN: —
EC: 200-120-5
UNII: 50D9XSG0VR
ICD-11: XM0YW4



$C_5\ H_{11}\ Cl_2\ N$

Colorless to dark liquid that has a fruity odor in high concentrations. The odor has been described as soapy in low concentrations. Salts are white solids.

Exposure Hazards

Conversion Factor: 1 ppm = 6.38 mg/m^3 at 77°F
$LCt_{50\ (Inh)}$: 1,000 mg-min/m^3 (78 ppm for a 2-minute exposure)
$LCt_{50\ (Per)}$: <85°F: 10,000 mg-min/m^3 (52 ppm for a 30-minute exposure)
$LCt_{50\ (Per)}$: >85°F: 5,000 mg-min/m^3 (26 ppm for a 30-minute exposure)
LD_{50}: 1.4 g
$ICt_{50\ (Skin)}$: <85°F: 500 mg-min/m^3 (2.6 ppm for a 30-minute exposure)
$ICt_{50\ (Skin)}$: >85°F: 200 mg-min/m^3 (1 ppm for a 30-minute exposure)
$ICt_{50\ (Eyes)}$: 75 mg-min/m^3 (5.9 ppm for a 2-minute exposure)
Eye Irritation: 2 ppm for a 2-minutes exposure
$MEG_{(1hr)}$: Neg: 0.00047 ppm; Mar: 0.0034 ppm; Crit: 0.058 ppm; Cat: —
PAC-1: 0.00031 ppm; *PAC-2:* 0.0034 ppm; *PAC-3:* 0.058 ppm

Interim AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 0.0034 ppm; 4 hr – 0.00088 ppm; 8 hr – 0.00044 ppm
AEGL-3: 1 hr – 0.058 ppm; 4 hr – 0.015 ppm; 8 hr – 0.0074 ppm

Properties:

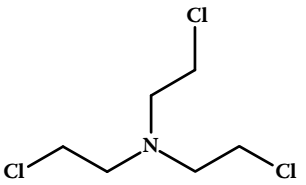
MW: 156.1	*VP:* 0.416 mmHg (77°F)	*FlP:* —
D: 1.1 g/mL (77°F)	*VD:* 5.4	*LEL:* —
MP: -94°F	*Vlt:* 550 ppm	*UEL*: —
BP: Decomposes	*ER:* —	*RP:* 19
Vsc: —	*H_2O:* 1.3%	*IP:* —
	Sol: Most organic solvents	

Hydrochloride Salt

MW: 192.6	*H_2O:* Very soluble
MP: 228°F	*Sol:* Ethanol

C03-A018

Nitrogen Mustard 3 (Agent HN3)
CAS: 555-77-1; 817-09-4 (Hydrochloride salt); 6138-32-5 (Picrate salt)
RTECS: YE2625000
UN: —
EC: 212-442-3
UNII: —
ICD-11: —



$C_6\ H_{12}\ Cl_3\ N$

Colorless to dark liquid that is odorless when pure. Salts are white solids.

Also reported as a mixture with Sulfur mustard (C03-A001).

Exposure Hazards

Conversion Factor: 1 ppm = 8.36 mg/m^3 at 77°F
$LCt_{50\ (Inh)}$: 1,000 mg-min/m^3 (60 ppm for a 2-minute exposure)
$LCt_{50\ (Per)}$: *<85°F:* 10,000 mg-min/m^3 (40 ppm for a 30-minute exposure)
$LCt_{50\ (Per)}$: *>85°F:* 5,000 mg-min/m^3 (20 ppm for a 30-minute exposure)
LD_{50}: 1.4 g
$ICt_{50\ (Skin)}$: *<85°F:* 500 mg-min/m^3 (2 ppm for a 30-minute exposure)
$ICt_{50\ (Skin)}$: *>85°F:* 200 mg-min/m^3 (0.8 ppm for a 30-minute exposure)
$ICt_{50\ (Eyes)}$: 75 mg-min/m^3 (4.4 ppm for a 2-minute exposure)
Eye Irritation: 1.5 ppm for a 2-minute exposure
$MEG_{(1hr)}$: Neg: 0.00036 ppm; Mar: 0.0026 ppm; Crit: 0.044 ppm; Cat: —
PAC-1: 0.00024 ppm; *PAC-2:* 0.0026 ppm; *PAC-3:* 0.044 ppm

Interim AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 0.0026 ppm; 4 hr – 0.00067 ppm; 8 hr – 0.00033 ppm
AEGL-3: 1 hr – 0.044 ppm; 4 hr – 0.011 ppm; 8 hr – 0.0056 ppm

Properties:

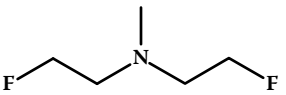
MW: 204.5	*VP:* 0.011 mmHg (77°F)	*FlP:* —
D: 1.2 g/mL (77°F)	*VD:* 7.1	*LEL:* —
MP: 25°F	*Vlt:* 14 ppm (77°F)	*UEL:* —
BP: Decomposes	*ER:* —	*RP:* 650
Vsc: 5.9 cS (77°F)	H_2O: 0.008%	*IP:* —
	Sol: Most organic solvents	

Hydrochloride Salt	**Picrate Salt**
MW: 241.0	*MW:* 321.6
MP: 266°F	*MP:* 278°F

C03-A019

2,2′-Difluoro-N-methyldiethylamine

CAS: 352-26-1; 6089-42-5 (Hydrobromide salt); 1598-80-7 (Hydrochloride salt)
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_5\ H_{11}\ F_2\ N$

Colorless liquid.

Exposure Hazards

Conversion Factor: 1 ppm = 5.03 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

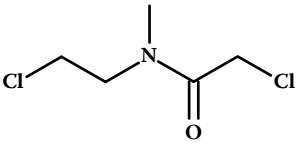
MW: 123.1	*VP:* —	*FlP:* —
D: —	*VD:* 4.2	*LEL:* —
MP: —	*Vlt:* —	*UEL:* —
BP: 253°F	*ER:* —	*RP:* —
Vsc: —	H_2O: —	*IP:* —
	Sol: —	

Hydrobromide Salt	**Hydrochloride Salt**
MW: 204.0	*MW:* 159.6
MP: 216°F	*MP:* 208°F

C03-A020

2-Chloroethyl Methyl 1-Chloroacetamide

CAS: 858817-94-4
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_5\ H_9\ Cl_2\ N\ O$

Specific information on physical appearance is not available for this agent.

Exposure Hazards

Conversion Factor: 1 ppm = 6.95 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

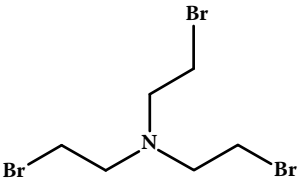
MW: 170.0	*VP:* —	*FlP:* —
D: —	*VD:* 5.9	*LEL:* —
MP: —	*Vlt:* —	*UEL:* —
BP: 230°F (0.8 mmHg)	*ER:* —	*RP:* —
Vsc: —	H_2O: —	*IP:* —
	Sol: —	

C03-A021

2,2′,2″-Tribromotriethylamine

CAS: 36647-05-9; 36647-06-0 (Hydrobromide salt)
RTECS: —
UN: —
EC: —

UNII: —
ICD-11: —



$C_6 H_{12} Br_3 N$

Solid.

Exposure Hazards

Conversion Factor: 1 ppm = 13.82 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 337.9	*VP:* —	*FlP:* —
D: —	*VD:* 12	*LEL:* —
MP: 86°F	*Vlt:* —	*UEL:* —
BP: 293°F (0.05 mmHg)	*ER:* —	*RP:* —
Vsc: —	H_2O: —	*IP:* —
	Sol: —	

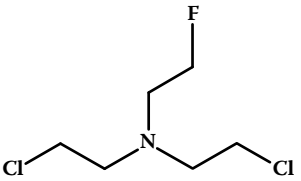
Hydrobromide Salt

MW: 418.8
MP: 307°F

C03-A022

Bis(2-chloroethyl) 2-Fluoroethylamine

CAS: 370-66-1
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_6 H_{12} Cl_2 F N$

Specific information on physical appearance is not available for this agent.

Exposure Hazards

Conversion Factor: 1 ppm = 7.69 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

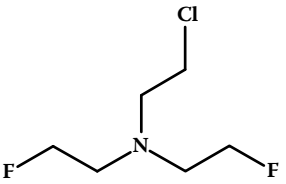
Properties:

MW: 188.1	*VP:* —	*FlP:* —
D: —	*VD:* 6.5	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 239°F (13 mmHg)	*ER:* —	*RP:* —
Vsc: —	H_2O: —	*IP:* —
	Sol: —	

C03-A023

Bis(2-fluoroethyl) 2-Chloroethylamine

CAS: 370-67-2; 445-59-0 (Picrate salt)
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_6\ H_{12}\ Cl\ F_2$

Specific information on physical appearance is not available for this agent.

Exposure Hazards

Conversion Factor: 1 ppm = 7.02 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 171.6	*VP:* —	*FlP:* —
D: —	*VD:* 5.9	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 203°F (19 mmHg)	*ER:* —	*RP:* —
Vsc: —	H_2O: —	*IP:* —
	Sol: —	

Picrate Salt

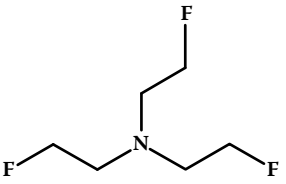
MW: 400.7
MP: 250°F

C03-A024

2,2′,2″-Trifluorotriethylamine

CAS: 370-68-3
RTECS: —
UN: —

EC: —
UNII: —
ICD-11: —



$C_6 H_{12} F_3 N$

Specific information on physical appearance is not available for this agent.

Exposure Hazards

Conversion Factor: 1 ppm = 6.35 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

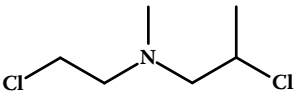
Properties:

MW: 155.2	*VP:* —	*FlP:* —
D: —	*VD:* 5.4	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 163°F (25 mmHg)	*ER:* —	*RP:* —
Vsc: —	H_2O: —	*IP:* —
	Sol: —	

C03-A025

2-Chloropropyl 2-Chloroethyl Methylamine

CAS: 139881-58-6; 859060-27-8 (Picrate salt)
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_6 H_{13} Cl_2 N$

Specific information on physical appearance is not available for this agent.

Exposure Hazards

Conversion Factor: 1 ppm = 6.96 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

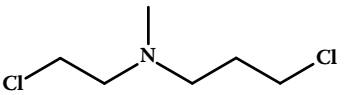
MW: 170.1	*VP:* —	*FlP:* —
D: —	*VD:* 5.9	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —

BP: 201°F (21 mmHg) | *ER:* — | *RP:* —
Vsc: — | H_2O: — | *IP:* —
Sol: —

Picrate Salt
MW: 399.2
MP: 252°F

C03-A026

3-Chloropropyl 2-Chloroethyl Methylamine
CAS: 89980-59-6
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_6\ H_{13}\ Cl_2\ N$

Specific information on physical appearance is not available for this agent.

Exposure Hazards
Conversion Factor: 1 ppm = 6.96 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

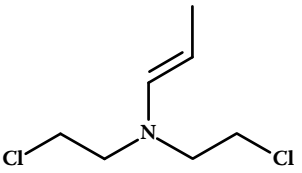
Properties:

MW: 170.1 | *VP:* — | *FlP:* —
D: — | *VD:* 5.9 | *LEL:* —
MP: — | *Vlt:* — | *UEL*: —
BP: 219°F (23 mmHg) | *ER:* — | *RP:* —
Vsc: — | H_2O: — | *IP:* —
Sol: —

Picrate Salt
MW: 399.2
MP: 167°F

C03-A027

Bis(2-chloroethyl) 1-Propene Amine
CAS: —
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_7\ H_{13}\ Cl_2\ N$

Specific information on physical appearance is not available for this agent.

Exposure Hazards

Conversion Factor: 1 ppm = 7.45 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 182.1	*VP:* —	*FlP:* —
D: —	*VD:* 6.3	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 176°F (3 mmHg)	*ER:* —	*RP:* —
Vsc: —	H_2O: —	*IP:* —
	Sol: —	

C03-A028

Bis(2-chloroethyl) 3-Chloropropylamine

CAS: 61134-73-4; 100608-14-8 (Picrate salt)

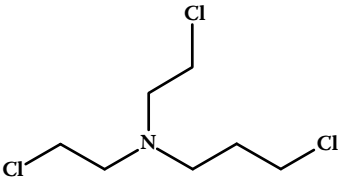
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



$C_7\ H_{14}\ Cl_3\ N$

Specific information on physical appearance is not available for this agent.

Exposure Hazards

Conversion Factor: 1 ppm = 8.94 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

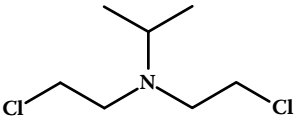
MW: 218.6	*VP:* —	*FlP:* —
D: —	*VD:* 7.5	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —

BP: 241°F (1.3 mmHg)
Vsc: —
ER: —
H_2O: —
Sol: —
RP: —
IP: —

Picrate Salt
MW: 447.7
MP: 199°F

C03-A029

Bis(2-chloroethyl) Isopropylamine
CAS: 619-34-1
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



C_7 H_{15} Cl_2 N

Specific information on physical appearance is not available for this agent.

Exposure Hazards
Conversion Factor: 1 ppm = 7.53 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

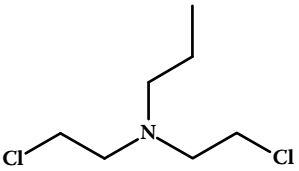
Properties:
MW: 184.1
D: —
MP: 10°F (est.)
BP: 194°F (8 mmHg)
Vsc: —
VP: 0.94 mmHg (est.)
VD: 6.4
Vlt: —
ER: —
H_2O: 0.5% (est.)
Sol: —
FlP: 120°F (est.)
LEL: —
UEL: —
RP: —
IP: —

Hydrochloride Salt
MW: 255.1
MP: 421°F

C03-A030

Bis(2-chloroethyl) Propylamine
CAS: 621-68-1; 38521-66-3 (Hydrochloride salt)
RTECS: UH9800000
UN: —
EC: —

UNII: —
ICD-11: —



$C_7\ H_{15}\ Cl_2\ N$

Specific information on physical appearance is not available for this agent.

Exposure Hazards

Conversion Factor: 1 ppm = 7.53 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 184.1	*VP:* 0.72 mmHg (est.)	*FlP:* 130°F (est.)
D: 1.1 g/mL (74°F)	*VD:* 6.4	*LEL:* —
MP: 4°F (ext.)	*Vlt:* —	*UEL*: —
BP: 205°F (10 mmHg)	*ER:* —	*RP:* —
Vsc: —	H_2O: 0.2% (est.)	*IP:* —
	Sol: —	

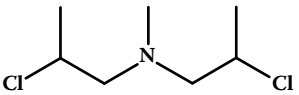
Hydrochloride Salt

MW: 220.6
MP: 221°F

C03-A031

Bis(2-chloropropyl) Methylamine

CAS: 52802-03-6
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_7\ H_{15}\ Cl_2\ N$

Specific information on physical appearance is not available for this agent.

Exposure Hazards

Conversion Factor: 1 ppm = 7.53 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

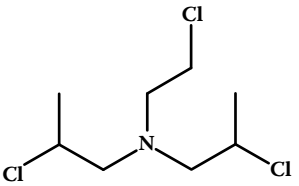
Properties:

MW: 184.1	*VP:* —	*FlP:* —
D: 1.2 g/mL	*VD:* 6.4	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 243°F (3 mmHg)	*ER:* —	*RP:* —
Vsc: —	H_2O: —	*IP:* —
	Sol: —	

C03-A032

Bis(2-chloropropyl) Chloroethylamine

CAS: 854873-81-7; 854873-82-8 (Picrate salt)
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_8 H_{16} Cl_3 N$

Specific information on physical appearance is not available for this agent.

Exposure Hazards

Conversion Factor: 1 ppm = 9.51 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 232.6	*VP:* —	*FlP:* —
D: —	*VD:* 8.0	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 243°F (3 mmHg)	*ER:* —	*RP:* —
Vsc: —	H_2O: —	*IP:* —
	Sol: —	

Picrate Salt

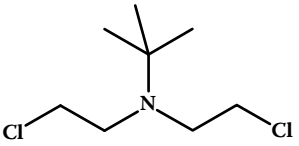
MW: 461.7
MP: 244°F

C03-A033

Bis(2-chloroethyl) t-Butylamine

CAS: 10125-86-7
RTECS: YE1300000
UN: —

EC: —
UNII: —
ICD-11: —



$C_8\ H_{17}\ Cl_2\ N$

Specific information on physical appearance is not available for this agent.

Exposure Hazards

Conversion Factor: 1 ppm = 8.10 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

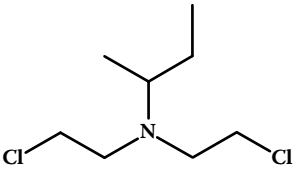
Properties:

MW: 198.1	*VP:* 1.34 mmHg (77°F)	*FlP:* 136°F
D: 1.0 g/mL (72°F)	*VD:* 6.8	*LEL:* —
MP: 40°F (est.)	*Vlt:* —	*UEL*: —
BP: 160°F (2 mmHg)	*ER:* —	*RP:* —
Vsc: —	H_2O: 0.3% (est.)	*IP:* —
	Sol: —	

C03-A034

Bis(2-chloroethyl) s-Butylamine

CAS: 777799-85-6
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_8\ H_{17}\ Cl_2\ N$

Specific information on physical appearance is not available for this agent.

Exposure Hazards

Conversion Factor: 1 ppm = 8.10 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 198.1	*VP:* —	*FlP:* —
D: 1.0 g/mL (77°F)	*VD:* 6.8	*LEL:* —

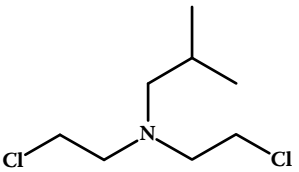
MP: —	*Vlt:* —	*UEL*: —
BP: 212°F (7.5 mmHg)	*ER:* —	*RP:* —
Vsc: —	H_2O: —	*IP:* —
	Sol: —	

C03-A035

Bis(2-chloroethyl) Isobutylamine

CAS: 87289-70-1
RTECS: —
UN: —
EC: —
UNII: —

ICD-11: —



C_8 H_{17} Cl_2 N

Specific information on physical appearance is not available for this agent.

Exposure Hazards

Conversion Factor: 1 ppm = 8.10 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

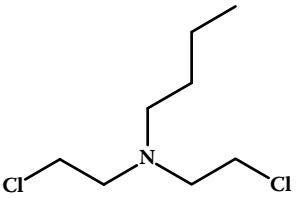
Properties:

MW: 198.1	*VP:* —	*FlP:* —
D: 1.0 g/mL (68°F)	*VD:* 6.8	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 174°F (2 mmHg)	*ER:* —	*RP:* —
Vsc: —	H_2O: —	*IP:* —
	Sol: —	

C03-A036

Bis(2-chloroethyl) Butylamine

CAS: 42520-97-8; 55112-89-5 (Hydrochloride salt)
RTECS: IA0525000
UN: —
EC: —
UNII: —
ICD-11: —



$C_8\ H_{17}\ Cl_2\ N$

Specific information on physical appearance is not available for this agent.

Exposure Hazards

Conversion Factor: 1 ppm = 8.10 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 198.1	*VP:* 0.27 mmHg (est.)	*FlP:* 147°F
D: 1.0 g/mL (77°F)	*VD:* 6.8	*LEL:* —
MP: 17°F (est.)	*Vlt:* —	*UEL*: —
BP: 241°F (13 mmHg)	*ER:* —	*RP:* —
Vsc: —	H_2O: 0.1% (est.)	*IP:* —
	Sol: —	

Hydrochloride Salt

MW: 234.6

MP: 203°F

C03-C COMPONENTS AND PRECURSORS

C03-C037

Thiodiglycol (TDG)

CAS: 111-48-8

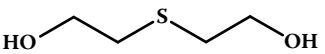
RTECS: KM2975000

UN: —

EC: 203-874-3

UNII: 9BW5T43J04

ICD-11: —



$C_4\ H_{10}\ O_2\ S$

Colorless to light yellow liquid with a foul odor. This material produces local skin/eye impacts.

Used industrially as an antioxidant, lubricant additive, printing-ink solvent, accelerator in the synthesis of rubber, and in the manufacture of plastics and pesticides.

This material is on Schedule 2 of the CWC, the Australia Group Export Control list and DHS Chemicals of Interest list.

This material is a precursor for sulfur mustard (C03-A001) and is also commonly found as an impurity and degradation product formed during its hydrolysis.

Exposure Hazards

Conversion Factor: 1 ppm = 5.00 mg/m^3 at 77°F
MEG$_{(1hr)}$: Neg: 15 ppm; Mar: —; Crit: 100 ppm; Cat: —
PAC-1: 4.0 ppm; *PAC-2:* 44 ppm; *PAC-3:* 260 ppm

Properties:

MW: 122.2	*VP:* 2×10^{-5} mmHg	*FlP:* 320°F
D: 1.2 g/mL	*VD:* 4.2	*LEL:* 1.2%
MP: 14°F	*Vlt:* —	*UEL*: 5.2%
BP: 542°F (decomposes)	*ER:* —	*RP:* 500,000
Vsc: —	H_2O: Miscible	*IP:* —
	Sol: Acetone, alcohols, chloroform	

C03-C038

Sulfur Monochloride

CAS: 10025-67-9
RTECS: WS4300000
UN: 1828
EC: 233-036-2
UNII: NJ7YR2EV0D
ICD-11: —

S_2Cl_2

Light-amber to yellow-red, oily fuming liquid with a suffocating, pungent, and nauseating odor. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts. It is non-corrosive to carbon steel and iron when dry. However, when wet it will attack steel, cast iron, aluminum, stainless steel, copper and copper alloys, and many nickel-based materials.

Used industrially for gold extraction and wood treatment; and to manufacture insecticides, pharmaceuticals, and dyes.

This material is on Schedule 3 of the CWC, the Australia Group Export Control list, DHS Chemicals of Interest list, and Australia Chemicals of Security Concern list.

This material is a general precursor for sulfur-based vesicants and has been used as an agent in a mixture with Chlorine (C10-A001).

Exposure Hazards

Conversion Factor: 1 ppm = 5.52 mg/m^3 at 77°F
Eye Irritation: 2 ppm; exposure duration unspecified

Lethal human toxicity values have not been established or have not been published. However, based on available information, this material appears to have a considerably greater acute toxicity than hydrogen chloride gas (C11-A088).

MEG$_{(1hr)}$: Neg: 0.53 ppm; Mar: 6.3 ppm; Crit: 15 ppm; Cat: —
PAC-1: 0.53 ppm; *PAC-2:* 6.3 ppm; *PAC-3:* 15 ppm
PEL: 1 ppm
Ceiling$_{(ACGIH)}$: 1 ppm

Ceiling$_{(NIOSH)}$: 1 ppm
IDLH: 5 ppm

Interim AEGLs
AEGL-1: 1 hr – 0.53 ppm; 4 hr – 0.33 ppm; 8 hr – 0.17 ppm
AEGL-2: 1 hr – 6.4 ppm; 4 hr – 4.0 ppm; 8 hr – 2.0 ppm
AEGL-3: 1 hr – 15 ppm; 4 hr – 9.6 ppm; 8 hr – 4.8 ppm

Properties:

MW: 135.0	*VP:* 6.8 mmHg	*FlP:* 266°F
D: 1.7 g/mL	*VD:* 4.7	*LEL:* —
MP: -107°F	*Vlt:* 9,100 ppm	*UEL*: —
BP: 276°F	*ER:* —	*RP:* 1.3
Vsc: —	H_2O: Reacts	*IP:* 9.40 eV
	Sol: Oils, ether	

C03-C039

Sulfur Dichloride
CAS: 10545-99-0
RTECS: —
UN: 1828
EC: 234-129-0
UNII: 8Q6684WQ9H
ICD-11: —

SCl_2
Fuming dark red to reddish-brown liquid with a pungent odor like chlorine. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts. It is non-corrosive to carbon steel and iron when dry. However, when wet it will attack steel, cast iron, aluminum, stainless steel, copper and copper alloys, and many nickel-based materials.

Used industrially for vulcanizing oils and rubber, purifying sugar juices, as a chloridizing agent in metallurgy and in the manufacture of insecticides.

This material is on the Australia Group Export Control list and Schedule 3 of the CWC.

This material is a general precursor for sulfur-based vesicants.

Exposure Hazards
Conversion Factor: 1 ppm = 4.21 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published. However, based on available information, this material appears to have a considerably greater acute toxicity than hydrogen chloride gas (C11-A088).

Properties:

MW: 103.0	*VP:* 7.6 mmHg (-9°F)	*FlP:* 245°F
D: 1.6 g/mL (59°F)	*VD:* 3.6	*LEL:* —
MP: -108°F	*Vlt:* 12,000 ppm (-9°F)	*UEL*: —
BP: 138°F (decomposes)	*ER:* —	*RP:* 1.1
Vsc: —	H_2O: Reacts	*IP:* 9.47 eV
	Sol: Carbon tetrachloride; benzene	

C03-C040

Thionyl Chloride

CAS: 7719-09-7
RTECS: XM5150000
UN: 1836; 137
EC: 231-748-8
UNII: 4A8YJA13N4
ICD-11: —

$SOCl_2$

Colorless to yellow to reddish fuming liquid with a pungent, suffocating odor like sulfur dioxide. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

Used in the manufacture of plastics, pesticides, pharmaceuticals, and dyes; and as a solvent in high energy density lithium batteries.

This material is on Schedule 3 of the CWC, the Australia Group Export Control list, DHS Chemicals of Interest list, Australia Chemicals of Security Concern list, and NRL Critical Threat list.

This material is used as a chlorinating agent for both nitrogen and sulfur-based vesicants. Required in the manufacture of methylphosphonic dichloride (C01-C051).

Exposure Hazards

Conversion Factor: 1 ppm = 4.87 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.20 ppm; Mar: 2.5 ppm; Crit: 14 ppm; Cat: —
PAC-1: 0.20 ppm; *PAC-2:* 2.5 ppm; *PAC-3:* 14 ppm
$Ceiling_{(ACGIH)}$: 0.2 ppm
$Ceiling_{(NIOSH)}$: 1 ppm

Interim AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 2.4 ppm; 4 hr – 0.59 ppm; 8 hr – 0.30 ppm
AEGL-3: 1 hr – 14 ppm; 4 hr – 3.4 ppm; 8 hr – 1.7 ppm

Properties:

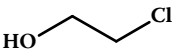
MW: 119.0	*VP:* 100 mmHg (70°F)	*FlP: NA*
D: 1.6 g/mL	*VD:* 4.1	*LEL: NA*
MP: -156°F	*Vlt:* 160,000 ppm	*UEL*: NA
BP: 169°F	*ER:* 330	*RP:* 0.78
Vsc: —	H_2O: Reacts	*IP:* 11.07 eV
	Sol: Benzene, chloroform	

C03-C041

2-Chloroethanol

CAS: 107-07-3
RTECS: KK0875000
UN: 1135; 131
EC: 203-459-7

UNII: 753N66IHAN
ICD-11: —



C_2 H_5 Cl O

Colorless liquid with a sweet, pleasant odor similar to ether. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local eye impacts. It does not cause immediate irritation to warn of skin exposure.

Used industrially as a solvent and cleaning agent; used to manufacture insecticides, dyes, pharmaceuticals, thiodiethylene glycol, ethylene oxide and ethylene glycol. Used in agriculture to treat sweet potatoes before planting.

This material is on the Australia Group Export Control list.

This material is a precursor for both nitrogen and sulfur-based vesicants.

Exposure Hazards

Conversion Factor: 1 ppm = 3.29 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.91 ppm; Mar: 4.0 ppm; Crit: 12 ppm; Cat: —
PAC-1: 0.11 ppm; *PAC-2:* 1.2 ppm; *PAC-3:* 3.6 ppm
PEL: 5 ppm [Skin]
$Ceiling_{(ACGIH)}$: 1 ppm [Skin]
$Ceiling_{(NIOSH)}$: 1 ppm [Skin]
IDLH: 7 ppm

Final AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 1.2 ppm; 4 hr – 0.47 ppm; 8 hr – 0.23 ppm
AEGL-3: 1 hr – 3.5 ppm; 4 hr – 1.4 ppm; 8 hr – 0.70 ppm

Properties:

MW: 80.5	*VP:* 7.18 mmHg (77°F)	*FlP:* 140°F
D: 1.2 g/mL	*VD:* 2.8	*LEL:* 4.9%
MP: –90°F	*Vlt:* 6,600 ppm	*UEL*: 15.9%
BP: 262°F	*ER:* —	*RP:* 2.2
Vsc: 2.9 cS	H_2O: Miscible (decomposes)	*IP:* 10.90 eV
	Sol: Most organic solvents	

C03-C042

Sodium Sulfide

CAS: 1313-82-2
RTECS: WE1905000
UN: 1385; 135
EC: 215-211-5
UNII: YGR27ZW0Y7
ICD-11: —

Na_2S

Clear white to yellow-pink deliquescent crystals with an odor like rotten eggs due to formation of hydrogen sulfide. Commercial material may be yellow or brick-red lumps or flakes. It is unstable and discolors upon exposure to air. It undergoes autoxidation to form polysulfur, thiosulfate, and sulfate. It absorbs carbon dioxide from the air to form sodium carbonate. Moist sodium sulfide is spontaneously flammable upon drying in air. This material is hazardous through ingestion and produces local skin/eye impacts.

Used industrially for dehairing hides, wool pulling, ore flotation, metal refining, engraving, cotton printing; in the manufacture of paper, pharmaceuticals, rubber, and sulfur dyes. It is used in production of heavy water for nuclear reactors.

This material is on the Australia Group Export Control list.

This material is a precursor for sulfur-based vesicants.

Exposure Hazards

Conversion Factor: 1 ppm = 3.19 mg/m^3 at 77°F
$MEC_{(1hr)}$: Neg: 2.5 mg/m^3; Mar: 15 mg/m^3; Crit: 75 mg/m^3; Cat: —
PAC-1: 0.62 mg/m^3; *PAC-2:* 6.9 mg/m^3; *PAC-3:* 41 mg/m^3

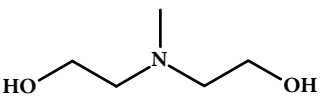
Properties:

MW: 78.0	*VP:* —	*FlP:* —
D: 1.9 g/cm^3 (57°F)	*VD:* —	*LEL:* —
MP: 2,156°F	*Vlt:* NA	*UEL*: —
BP: —	*ER:* NA	*RP:* NA
Vsc: —	H_2O: 19%	*IP:* —
	Sol: Alcohols	

C03-C043

Methyldiethanolamine

CAS: 105-59-9
RTECS: KL7525000
UN: —
EC: 203-312-7
UNII: 3IG3K131QJ
ICD-11: —



$C_5\ H_{13}\ N\ O_2$

Clear, colorless to light-yellow liquid with an odor like ammonia. Various salts (solids) have been reported. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts.

This material is on Schedule 3 of the CWC, the DHS Chemicals of Interest list, and Australia Chemicals of Security Concern list.

This material is a precursor for HN2 (C03-A017). It is also commonly found as a degradation product from hydrolysis of HN2.

Exposure Hazards

Conversion Factor: 1 ppm = 4.88 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

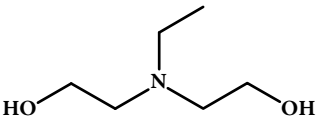
Properties:

MW: 119.2	*VP:* 0.019 mmHg (104°F)	*FlP:* 259°F
D: 1.0 g/mL	*VD:* 4.1	*LEL:* 0.9%
MP: –6°F	*Vlt:* 24 ppm (104°F)	*UEL*: 8.4%
BP: 477°F	*ER:* —	*RP:* 4.1
Vsc: 97 cS	H_2O: Miscible	*IP:* —
	Sol: —	

C03-C044

Ethyldiethanolamine

CAS: 139-87-7
RTECS: KK9800000
UN: —
EC: 205-379-8
UNII: 143560H1KL
ICD-11: —



$C_6\ H_{15}\ N\ O_2$

Clear, colorless to light-yellow liquid with an odor like ammonia. Various salts (solids) have been reported. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts.

This material is on Schedule 3 of the CWC, the Australia Group Export Control list, DHS Chemicals of Interest list, and Australia Chemicals of Security Concern list.

This material is a precursor for HN1 (C03-A016). It is also commonly found as a degradation product from hydrolysis of HN1.

Exposure Hazards

Conversion Factor: 1 ppm = 4.30 mg/m^3 at 77°F
Human toxicity values have not been established or have not been published.

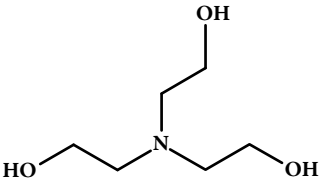
Properties:

MW: 105.1	*VP:* 0.00449 mmHg (77°F)	*FlP:* 253°F
D: 1.0 g/mL	*VD:* 3.6	*LEL:* —
MP: –58°F	*Vlt:* 5.9 ppm (77°F)	*UEL*: —
BP: 480°F	*ER:* —	*RP:* 2,200
Vsc: —	H_2O: Miscible	*IP:* —
	Sol: Ethanol; slight in ether	

C03-C045

Triethanolamine

CAS: 102-71-6
RTECS: KL9275000
UN: —
EC: 203-049-8
UNII: 9O3K93S3TK
ICD-11: XM8F93



$C_6\ H_{15}\ N\ O_3$

Colorless to pale yellow viscous hydroscopic liquid with a slight odor like ammonia. Turns brown on exposure to air and light. Various salts (solids) have been reported. This material produces local skin/eye impacts.

Used industrially as a corrosion inhibitor for lubricants and in the manufacture of cosmetics, detergents, emulsifiers, and surfactants.

This material is on Schedule 3 of the CWC, the Australia Group Export Control list, DHS Chemicals of Interest list, and Australia Chemicals of Security Concern list.

This material is a precursor for HN3 (C03-A018). It is also commonly found as a degradation product from hydrolysis of HN3.

Exposure Hazards

Conversion Factor: 1 ppm = 6.10 mg/m^3 at 77°F
MEC$_{(1hr)}$: Neg: 0.82 ppm; Mar: 3.3 ppm; Crit: 82 ppm; Cat: —
PAC-1: 2.5 ppm; *PAC-2:* 39 ppm; *PAC-3:* 250 ppm
TLV: 0.82 ppm

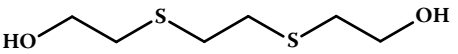
Properties:

MW: 149.2	*VP:* 3.6 × 10^{-6} mmHg (77°F)	*FlP:* 374°F
D: 1.1 g/mL	*VD:* 5.1	*LEL:* 3.6%
MP: 69°F	*Vlt:* —	*UEL*: 7.2%
BP: 636°F	*ER:* —	*RP:* 2,000,000
Vsc: 530 cS (77°F)	H_2O: Miscible	*IP:* 7.9 eV
	Sol: Alcohols, acetone, chloroform, benzene	

C03-D DECOMPOSITION PRODUCTS AND IMPURITIES

C03-D046

1,2-Bis(2-hydroxyethylthio)ethane (Q-diol)
CAS: 5244-34-8
RTECS: —
UN: —
EC: 226-045-8
UNII: KBC80263G6
ICD-11: —



$C_6 H_{14} O_2 S_2$

White crystalline solid. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts.

This material is commonly found as a degradation product from hydrolysis of Sulfur mustard (C03-A001).

Exposure Hazards

Conversion Factor: 1 ppm = 7.46 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 182.3	*VP:* 7.5×10^{-5} mmHg (est.)	*FlP:* 357°F
D: 1.2 g/mL	*VD:* 6.3	*LEL:* —
MP: 145°F	*Vlt:* —	*UEL:* —
BP: 338°F (0.5 mmHg)	*ER:* —	*RP:* —
Vsc: —	H_2O: 3% (est.)	*IP:* —
	Sol: —	

C03-D047

Ethylene Sulfide
CAS: 420-12-2
RTECS: KX3500000
UN: —
EC: 206-993-9
UNII: A2W5165740
ICD-11: —



$C_2 H_4 S$

Colorless liquid that gradually polymerizes. It may be stabilized with 0.5% butyl mercaptan. Ethylene sulfide is hazardous through inhalation and ingestion, and produces local skin/eye impacts.

Used industrially as a chemical intermediate.

This material is commonly found as an impurity in sulfur mustard (C03-A001).

Exposure Hazards

Conversion Factor: 1 ppm = 2.46 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published. However, based on available information, this material appears to be approximately six times as toxic as propylene oxide.

Properties:

MW: 60.1	*VP:* 375 mmHg (77°F)	*FlP:* 50°F
D: 1.0 g/mL (32°F)	*VD:* 2.1	*LEL:* —
MP: –164°F	*Vlt:* 490,000 ppm (77°F)	*UEL:* —
BP: 131°F	*ER:* —	*RP:* 0.035
Vsc: —	H_2O: Insoluble	*IP:* 9.05 eV
	Sol: Alcohol; ether; acetone; chloroform	

C03-D048

1,2-Ethanedithiol

CAS: 540-63-6

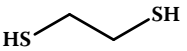
RTECS: KI3325000

UN: —

EC: 208-752-3

UNII: 92T634FLAR

ICD-11: —



C_2 H_6 S_2

Liquid with a foul odor detectable at ≥31 ppb and easily noticeable at 5.6 ppm. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts.

Used industrially as a metal-complexing agent.

This material is a degradation product in sulfur mustard (C03-A001).

Exposure Hazards

Conversion Factor: 1 ppm = 3.85 mg/m^3 at 77°F

MEG$_{(1hr)}$: Neg: 1.0 ppm; Mar: 7.8 ppm; Crit: 39 ppm; Cat: —

PAC-1: 0.15 ppm; *PAC-2:* 1.6 ppm; *PAC-3:* 9.6 ppm

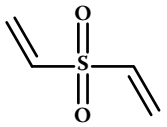
Properties:

MW: 94.2	*VP:* 4.8 mmHg	*FlP:* 111°F
D: 1.1 g/mL (74°F)	*VD:* 3.3	*LEL:* —
MP: –42°F	*Vlt:* 7,500 ppm (77°F)	*UEL:* —
BP: 295°F	*ER:* —	*RP:* 1.8
Vsc: —	*H_2O:* Insoluble	*IP:* 9.35 eV
	Sol: Ethanol, ether, acetone, benzene	

C03-D049

Divinyl Sulfone

CAS: 77-77-0
RTECS: KM7175000
UN: 5PFN71LP8M
EC: 201-057-6
UNII: —
ICD-11: —



$C_4\ H_6\ O_2\ S$

Clear colorless liquid. It may be stabilized with <0.1% hydroquinone. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts.

Used industrially to Synthesis of fiber-reactive dyestuffs.

This material is a degradation product from sulfur mustard (C03-A001).

Exposure Hazards

Conversion Factor: 1 ppm = 4.83 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published. However, it can cause burns of the skin and eyes similar to those from sulfur mustard (C03-A001), but it does not liberate chlorine.

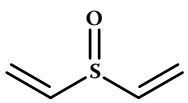
Properties:

MW: 118.2	*VP:* 0.09 mmHg	*FlP:* 217°F
D: 1.2 g/mL (77°F)	*VD:* 4.1	*LEL:* —
MP: –15°F	*Vlt:* 120 ppm	*UEL*: —
BP: 453°F	*ER:* —	*RP:* 100
Vsc: —	H_2O: 14%	*IP:* 10.56 eV
	Sol: —	

C03-D050

Vinyl Sulfoxide

CAS: 1115-15-7
RTECS: YZ9800000
UN: —
EC: —
UNII: 4W5026ZW8G
ICD-11: —



$C_4\ H_6\ O\ S$

Specific information on physical appearance is not available for this material.

This material is a degradation product from sulfur mustard (C03-A001).

Exposure Hazards

Conversion Factor: 1 ppm = 4.18 mg/m^3 at 77°F
MEG$_{(1hr)}$: Neg: 0.60 ppm; Mar: 3.6 ppm; Crit: 18 ppm; Cat: —
PAC-1: 0.096 ppm; *PAC-2:* 1.1 ppm; *PAC-3:* 6.2 ppm

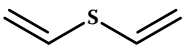
Properties:

MW: 102.2	*VP:* 0.224 mmHg (77°F)	*FlP:* 183°F
D: 1.1 g/mL	*VD:* 3.5	*LEL:* —
MP: —	*Vlt:* 1,200 ppm	*UEL*: —
BP: 419°F	*ER:* —	*RP:* 11
Vsc: —	H_2O: 28%	*IP:* —
	Sol: —	

C03-D051

Divinyl Sulfide

CAS: 627-51-0
RTECS: —
UN: —
EC: —
UNII: CL87X0NVJA
ICD-11: —



C_4 H_6 S

Liquid. Other information on physical appearance is not available for this material.

This material is a degradation product from sulfur mustard (C03-A001).

Exposure Hazards

Conversion Factor: 1 ppm = 3.53 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

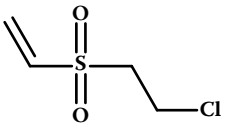
MW: 86.2	*VP:* 6.0 mmHg	*FlP:* —
D: 0.87 g/mL	*VD:* 3.0	*LEL:* —
MP: —	*Vlt:* 8,000 ppm	*UEL*: —
BP: 183°F	*ER:* —	*RP:* 1.8
Vsc: —	H_2O: 0.25%	*IP:* 8.25 eV
	Sol: —	

C03-D052

2-Chloroethyl Vinylsulfone

CAS: 7327-58-4
RTECS: —

UN: —
EC: —
UNII: —
ICD-11: —



$C_4 H_7 Cl O_2 S$

Specific information on physical appearance is not available for this material.

This material is a degradation product from sulfur mustard (C03-A001).

Exposure Hazards

Conversion Factor: 1 ppm = 6.32 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

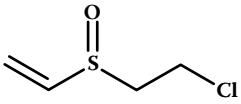
Properties:

MW: 154.6	*VP:* 0.023 mmHg	*FlP:* —
D: —	*VD:* 5.3	*LEL:* —
MP: 99°F (est.)	*Vlt:* 31 ppm	*UEL:* —
BP: 471°F (est.)	*ER:* —	*RP:* 350
Vsc: —	H_2O: 7.8%	*IP:* —
	Sol: —	

C03-D053

2-Chloroethyl Vinylsulfoxide

CAS: 40709-82-8
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_4 H_7 Cl O S$

Specific information on physical appearance is not available for this material.

This material is a degradation product from sulfur mustard (C03-A001).

Exposure Hazards

Conversion Factor: 1 ppm = 5.67 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

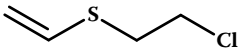
Properties:

MW: 138.6	*VP:* 0.064 mmHg	*FlP:* 256°F
D: 1.3 g/mL	*VD:* 4.8	*LEL:* —
MP: 96°F (est.)	*Vlt:* 86 ppm	*UEL:* —
BP: 540°F	*ER:* —	*RP:* 130
Vsc: —	H_2O: 16%	*IP:* ~10 eV
	Sol: —	

C03-D054

2-Chloroethyl Vinylsulfide

CAS: 81142-02-1
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



C_4 H_7 Cl S

Specific information on physical appearance is not available for this material.

This material is a degradation product from sulfur mustard (C03-A001).

Exposure Hazards

Conversion Factor: 1 ppm = 5.01 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.080 ppm; Mar: 0.60 ppm; Crit: 3.0 ppm; Cat: —
PAC-1: 0.0068 ppm; *PAC-2:* 0.076 ppm; *PAC-3:* 0.46 ppm

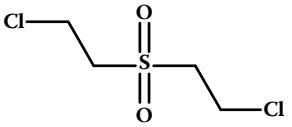
Properties:

MW: 122.6	*VP:* 5.8 mmHg	*FlP:* 142°F
D: 1.1 g/mL	*VD:* 4.2	*LEL:* —
MP: –44°F (est.)	*Vlt:* 7,800 ppm	*UEL:* —
BP: 331°F	*ER:* —	*RP:* 1.5
Vsc: —	H_2O: 0.14%	*IP:* —
	Sol: —	

C03-D055

Bis(2-chloroethyl) Sulfone

CAS: 471-03-4
RTECS: WR3325000
UN: —
EC: —
UNII: —
ICD-11: —



$C_4 H_8 Cl_2 O_2 S$

Solid. Other specific information on physical appearance is not available for this material.

This material is a degradation product from sulfur mustard (C03-A001).

Exposure Hazards

Conversion Factor: 1 ppm = 7.82 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published. However, based on available information, this material is nearly as powerful a vesicant as the parent compound.

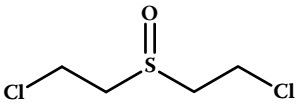
Properties:

MW: 191.1	*VP:* 1.66×10^{-4} mmHg (77°F)	*FlP:* 320°F
D: 1.4 g/cm^3	*VD:* 6.6	*LEL:* —
MP: 133°F	*Vlt:* —	*UEL:* —
BP: 645°F	*ER:* —	*RP:* 44,000
Vsc: —	H_2O: 1.1%	*IP:* —
	Sol: —	

C03-D056

Bis(2-chloroethyl) Sulfoxide

CAS: 5819-08-9
RTECS: WS2100000
UN: —
EC: —
UNII: —
ICD-11: —



$C_4 H_8 Cl_2 O S$

Specific information on physical appearance is not available for this material.

This material is a degradation product from sulfur mustard (C03-A001).

Exposure Hazards

Conversion Factor: 1 ppm = 7.16 mg/m^3 at 77°F
Unlike the sulfone (C03-D055) this material is not a vesicant.
MEG$_{(1hr)}$: Neg: 0.18 ppm; Mar: 1.0 ppm; Crit: 5.6 ppm; Cat: —
PAC-1: 0.073 ppm; *PAC-2:* 0.80 ppm; *PAC-3:* 4.7 ppm

Properties:

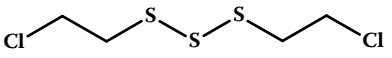
MW: 175.1	*VP:* 0.65 mmHg	*FlP:* —
D: —	*VD:* 6.0	*LEL:* —

MP: 113°F (est.)	*Vlt:* 870 ppm	*UEL:* —
BP: 514°F (est.)	*ER:* —	*RP:* 12
Vsc: —	H_2O: 1.2%	*IP:* ~8.8 eV
	Sol: —	

C03-D057

Bis(2-chloroethyl)trisulfide

CAS: 19149-77-0
RTECS: KN3339000
UN: —
EC: —
UNII: —
ICD-11: —



$C_4 H_8 Cl_2 S_3$

Clear, colorless hygroscopic liquid.

This material is commonly found as an impurity in sulfur mustard (C03-A001).

Exposure Hazards

Conversion Factor: 1 ppm = 9.13 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

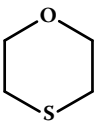
Properties:

MW: 223.2	*VP:* 1.7 mmHg	*FlP:* 135°F
D: 0.94 g/mL	*VP:* 2.96 mmHg (77°F)	*LEL:* —
MP: –90°F	*VD:* 4.6	*UEL:* —
BP: 324°F	*Vlt:* 2,300 ppm	*RP:* 3.9
Vsc: —	*ER:* —	*IP:* 9.8 eV
	H_2O: Miscible	
	Sol: —	

C03-D058

1,4-Oxathiane

CAS: 15980-15-1
RTECS: RP4200000
UN: —
EC: 240-117-6
UNII: 2X66H33V2V
ICD-11: —



$C_4 H_8 O S$

Clear, colorless to light yellow liquid.

This material is commonly found as an impurity in sulfur mustard (C03-A001).

Exposure Hazards

Conversion Factor: 1 ppm = 4.26 mg/m^3 at 77°F
MEG$_{(1hr)}$: Neg: 12 ppm; Mar: 82 ppm; Crit: 350 ppm; Cat: —
PAC-1: 2.58 ppm; *PAC-2:* 28 ppm; *PAC-3:* 170 ppm

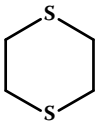
Properties:

MW: 104.2	*VP:* 3.9 mmHg	*FlP:* 107°F
D: 1.1 g/mL	*VD:* 3.6	*LEL:* —
MP: 32°F	*Vlt:* 5,200 ppm	*UEL*: —
BP: 297°F	*ER:* —	*RP:* 2.5
Vsc: —	H_2O: 16.7%	*IP:* 8.8 eV
	Sol: —	

C03-D059

1,4-Dithiane

CAS: 505-29-3
RTECS: JO5069000
UN: —
EC: 208-007-2
UNII: 3274B1T5A0
ICD-11: —



C_4 H_8 S_2

White crystalline solid with a foul smell.

This material is commonly found as an impurity and degradation product from sulfur mustard (C03-A001).

Exposure Hazards

Conversion Factor: 1 ppm = 4.92 mg/m^3 at 77°F
Human toxicity values have not been established or have not been published.

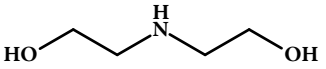
Properties:

MW: 120.2	*VP:* 0.80 mmHg	*FlP:* 179°F
D: —	*VD:* 4.1	*LEL:* —
MP: 225°F	*Vlt:* 1,100 ppm	*UEL*: —
BP: 392°F	*ER:* —	*RP:* 11
Vsc: —	H_2O: 0.30%	*IP:* 8.8 eV
	Sol: Ethanol, ether, carbon tetrachloride	

C03-D060

Diethanolamine

CAS: 111-42-2
RTECS: KL2975000
UN: —
EC: 203-868-0
UNII: AZE05TDV2V
ICD-11: XM58E5



$C_4\ H_{11}\ N\ O_2$

Viscous, syrupy liquid or crystalline deliquescent solid with a mild odor like ammonia. Various salts (solids) have been reported. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts.

Used in the manufacture of emulsifiers, dispersing agents, cutting oils, shampoos, cleaners and polishes. Chemical intermediate for morpholine.

This material is a degradation product from HN1 (C03-A016).

Exposure Hazards

Conversion Factor: 1 ppm = 4.30 mg/m^3 at 77°F
$LD_{50\ (Ing)}$: 20 g (est.)
$MEG_{(1hr)}$: Neg: 150 mg/m^3; Mar: —; Crit: 300 mg/m^3; Cat: —
PAC-1: 3.0 mg/m^3; *PAC-2:* 28 mg/m^3; *PAC-3:* 130 mg/m^3
REL: 15 mg/m^3
TLV: 1 mg/m^3 [Skin]

Properties:

MW: 105.1	*VP:* 1.4×10^{-4} mmHg (77°F)	*FlP:* 342°F
D: 1.1 g/cm^3	*VD:* 3.7	*LEL:* 1.7%
MP: 82°F	*Vlt:* —	*UEL*: 9.8%
BP: 516°F	*ER:* —	*RP:* 70,0000
Vsc: 320 cS (86°F)	H_2O: Miscible	*IP:* —
	Sol: Alcohols, acetone, chloroform	

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4 Arsenic Vesicants

GENERAL INFORMATION

The agents in this class are dihalo organoarsines. Other than lewisite (C04-A002), which is listed in Schedule 1, these materials are not covered by the Chemical Weapons Convention. Some of them have even seen limited commercial applications.

The majority of these materials were employed in World War I. They are moderately difficult to synthesize and can be difficult to disperse effectively. For information on some of the chemicals used to manufacture arsenic vesicants, see the component section (C04-C) following information on the individual agents. Materials easily converted into lewisite (i.e., lewisite 2 (C14-A004, Volume 2) and lewisite 3 (C04-C007)) are listed in Schedule 1; while the precursor arsenic trichloride (C04-C006) is listed in Schedule 2.

In addition to the agents detailed in this handbook, there are other arsenic vesicants that were employed during World War I on a limited basis. However, there is little or no published information concerning the physical, chemical, or toxicological properties of these additional agents.

Toward the end of World War I, lewisite (C04-A002) was developed, produced, and weaponized but never used. Despite this, it has supplanted all other agents as the arsenic vesicant of choice and is the only one that was stockpiled in modern arsenals.

TOXICOLOGY

Effects

Vesicants affect both exterior and interior parts of the body. Vesicants cause inflammation, blisters, and general destruction of tissues. These agents have a greater impact on moist areas of the body. Eyes are especially susceptible to vesicants and contact results in irritation, tearing (lacrimation), and involuntary blinking (blepharospasm).

Inhalation of vesicants can cause lung membranes to swell and become filled with liquid (pulmonary edema). Death may result from lack of oxygen.

Arsenic vesicants are also systemic agents and can pass through the skin to affect susceptible tissue including blood cells and the liver. Arsenic vesicants also act as vomiting/sternatory agents (see C14, Volume 2) and produce violent coughing, sneezing, and regurgitation. Some arsenic vesicants are carcinogenic.

Pathways and Routes of Exposure

Vesicants are hazardous through any route of exposure including inhalation, skin and eye exposure, ingestion, and broken, abraded, or lacerated skin (e.g., penetration of skin by debris). Liquid agents are much more hazardous than their vapors. Thickened agents primarily pose a hazard through skin absorption.

General Exposure Hazards

Arsenic vesicants cause instantaneous irritation of the eyes, nose, throat, and skin, which provides warning of their presence. Extended exposures cause violent coughing, sneezing, and regurgitation.

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The odor of arsenic vesicants varies with the individual compound and ranges from odorless to fruity to flowery. Odors may not be discernable due to irritation.

Lethal concentrations (LC_{50}s) for inhalation of these agents are as low as 59 parts per million for a 2-minute exposure.

Lethal percutaneous exposures (LD_{50}s) to liquid agents are as low as 1.4 grams per individual.

Incapacitating concentrations (ICt_{50}) for dermal exposure to these agents at moderate temperatures (i.e., between 65° and 85°F) are as low as two parts per million for a 30-minute exposure. Temperatures above 85°F reduce the concentration necessary to produce similar effects.

Eye irritation from exposure to agent vapors occurs at concentrations as low as 0.9 parts per million for a 2-minute exposure; an incapacitating concentration (ICt_{50}) for exposure of the eyes is as low as 4.4 parts per million for a 2-minute exposure. Permanent eye damage may occur at concentrations as low as 90 parts per million for a 2-minute exposure.

Although sub-lethal doses of some arsenic vesicants are rapidly detoxified by the body, many agents are not detoxified and exposures are cumulative.

Latency Period

Vapor/Aerosols (mists or dusts)

Inhalation of high concentrations may be fatal in as short a time as 10 minutes. Otherwise, arsenic vesicants produce immediate irritation of the eyes and involuntary blinking (blepharospasm), followed by lacrimation. Nasal irritation is coupled with coughing, sneezing, and vomiting. There is an immediate burning sensation when the agent comes into contact with the skin. Other signs and symptoms of exposure, including reddening of the skin (erythema), blistering (vesication), and accumulation of fluid in the lungs (pulmonary edema) do not occur until after a substantial latency period.

Liquids

Arsenic vesicants produce immediate pain. Tissue damage occurs within minutes of exposure but clinical effects may not appear for up to 24 hours. Some agents are rapidly absorbed through the skin. Extensive skin contamination may cause systemic damage to the liver, kidneys, nervous system, red blood cells, and the brain.

CHARACTERISTICS

Physical Appearance/Odor

Laboratory Grade

Laboratory grade agents are typically colorless oily liquids. They have little or no odor. Vapors are extremely irritating to the eyes, nose, throat, and skin.

Munition Grade

Munition grade agents are typically yellow to dark brown liquids or solids. As the agent ages and decomposes, it continues to discolor until it may appear black. Production impurities and decomposition products in these agents may give them an odor. Odors range from fruity and biting, to flowery and similar to geraniums. Odors may become more pronounced during storage.

Modified Agents

Arsenic vesicants have been thickened with various substances to enhance deployment, increase their persistency, and increase the risk of percutaneous exposure. Thickeners include polyalkyl methacrylates (methyl, ethyl, butyl, isobutyl), polyvinyl acetate, polystyrene, Plexiglas, alloprene, polychlorinated isoprene, nitrocellulose, as well as bleached montan and lignite waxes. Military thickener K125 is a mixture of methyl, ethyl, and butyl polymethacrylates. When thickened, agents

become sticky with a consistency similar to honey. Typically, not enough thickener is added to affect either the color or odor of the agent.

Mixtures with Other Agents

Lewisite (C04-A002) has been mixed with sulfur mustard (C03-A001) to prevent the sulfur mustard from freezing in the shell as well as to enhance its toxicity.

Stability

Arsenic vesicants are stable when pure and kept dry. Stabilizers are not required. Agents can be stored in glass or steel containers, although they may attack steel at elevated temperature or if moisture is present. Arsenic vesicants corrode aluminum and brass, and will attack some rubbers and plastics.

Persistency

For military purposes, unmodified arsenic vesicants are classified as persistent. However, agent vapors rapidly react with high humidity to lose most of their vesicant properties. Limited solubility slows the hydrolysis of liquid agents. Some hydrolysis products are highly toxic and extremely persistent (see hazardous decomposition products below). Evaporation rates range from near that of water down to that of light machine oil.

Agents modified with thickeners last significantly longer in the environment.

Environmental Fate

Arsenic vesicant vapors have a density greater than air and tend to collect in low places. Agent vapor is rapidly decomposed by moisture in the air. Porous material, including painted surfaces, will absorb both liquid and gaseous agent. After the initial surface contamination has been removed, agent that has been absorbed into porous material can migrate back to the surface posing both a contact and vapor hazard. Clothing may emit trapped agent vapor for up to 30 minutes after contact with a vapor cloud.

Liquid agents that do dissolve in water are rapidly decomposed. However, most of these agents are insoluble in water and this limited solubility slows their hydrolysis. Hydrolysis of agents may be further reduced if they are thickened such that a protective layer forms at the agent/water interface. The specific gravities of unmodified liquid agents are much greater than that of water. These agents are soluble in most organic solvents including gasoline, oils, acetone, and alcohols.

ADDITIONAL HAZARDS

Exposure

All foodstuffs in the area of a release should be considered contaminated. Unopened items packaged in glass, metal, or heavy-duty plastic and exposed only to agent vapors may be used after decontamination of the container. Unopened items exposed to liquid agents should be decontaminated within a few hours post-exposure or destroyed. Opened or unpackaged items, or those packaged only in paper or cardboard, should be destroyed.

Meat and milk from animals affected by arsenic vesicants should be destroyed.

Livestock/Pets

Although vesicants do not produce the same type of dermal damage in animals as they do in humans, they are still susceptible to the cytotoxic and systemic toxicities of these agents.

Animals can be decontaminated with shampoo/soap and water, or a 0.5% household bleach solution (see the decontamination section below). If the animal's eyes have been exposed to agent, they should be irrigated with water or saline solution for a minimum of 30 minutes.

Unprotected feedstock (e.g., hay or grain) should be destroyed. Leaves of forage vegetation could still retain sufficient vesicant agent, or toxic decomposition products, to produce effects for several weeks post-release, depending on the level of contamination and the weather conditions.

Fire

Heat from a fire will increase the amount of agent vapor in the area. A significant amount of the agent could be volatilized and escape into the surrounding environment before it is consumed by the fire. Actions taken to extinguish the fire can also spread the agent. Combustion or hydrolysis of arsenic vesicants will produce volatile, toxic decomposition products (see hazardous decomposition products below).

Reactivity

Although these agents will decompose if dissolved in water, a lack of solubility inhibits this process. Vapors are decomposed rapidly by high humidity.

Hazardous Decomposition Products

Hydrolysis

Arsenic vesicants produce hydrogen chloride (HCl) or hydrogen bromide (HBr), and arsenous oxides or arsenic salts when hydrolyzed. Some arsenous oxide decomposition products are toxic and may also have vesicant properties. Some agents may produce acetylene at higher pH.

Combustion

Volatile decomposition products may include hydrogen chloride (HCl), hydrogen bromide (HBr), and arsenic oxides. In addition, a corrosive and/or toxic residue may remain.

PROTECTION

Evacuation Recommendations

Isolation and protective action distances listed below are taken from the 2020 Emergency Response Guidebook. These recommendations are based on different release mechanisms (i.e., direct aerosolization, spraying, or an explosively generated mist) as well as various quantities of material depending on the agent used in the release.

For L, the release scenario involves either a spray or an explosively generated mist that quickly settles to the ground and soaks in to a depth of no more than 0.25 millimeters. A secondary cloud will then be generated by evaporation of this deposited material. A small release of lewisite involves 2 kilograms (approximately 1.1 liters) of liquid agent and a large release involves 25 kilograms (approximately 13 liters) of liquid agent.

For ED, MD, and PD, the release involves direct aerosolization of the liquid agents with a particle size between two and ten microns. For MD and PD, a small release involves 30 kilograms (approximately 18 liters) of liquid agent and a large release involves 500 kilograms (approximately 290 liters) of liquid agent. For ED, a small release involves 10 kilograms (approximately 5.9 liters) of liquid agent and a large release involves 500 kilograms (approximately 290 liters) of liquid agent.

ED (Ethyldichloroarsine) *C04-A001*

	Initial Isolation	Downwind Day	Downwind Night
Small device (10 kg)	150 m	0.9 km	2.1 km
Large device (500 kg)	1,000 m	5.9 km	8.3 km

L (Lewisite) *C04-A002*

	Initial Isolation	Downwind Day	Downwind Night
Small device (2 kg)	30 m	0.1 km	0.3 km
Large device (25 kg)	100 m	0.5 km	1.0 km

MD (Methyldichloroarsine) *C04-A003*

	Initial Isolation	Downwind Day	Downwind Night
Small device (30 kg)	300 m	1.6 km	4.3 km
Large device (500 kg)	1,000 m	11+ km	11+ km

PD (Phenyldichloroarsine) *C04-A004*

	Initial Isolation	Downwind Day	Downwind Night
Small device (30 kg)	60 m	0.4 km	0.4 km
Large device (500 kg)	300 m	1.6 km	1.6 km

Personal Protective Requirements

Structural Firefighters' Gear

Structural firefighters' protective clothing is recommended for fire situations only; it is not effective in spill situations or release events and should never be used as the primary chemical protective garment to enter an area contaminated with arsenic vesicants.

Respiratory Protection

Self-contained breathing apparatuses (SCBAs) or air purifying respirators (APRs) should have a National Institute for Occupational Safety and Health (NIOSH) Chemical/Biological/Radiological/Nuclear (CBRN) certification since vesicants can degrade the materials used to make some respirators. However, during emergency operations, other NIOSH-approved SCBAs or APRs that have been specifically tested by the manufacturer against chemical warfare agents may be used if deemed necessary by the incident commander. APRs should be equipped with a NIOSH-approved CBRN filter or a combination organic vapor/acid gas/particulate cartridge.

Immediately dangerous to life or health (IDLH) levels are the ceiling limit for respirators other than SCBAs. However, NIOSH IDLH levels have not been established for arsenical vesicants. Therefore, any potential exposure to these agents should be regarded with extreme caution and the use of SCBAs for respiratory protection should be considered.

Chemical Protective Clothing

Use only chemical protective clothing that has undergone material and construction performance testing against arsenic vesicant agents. Reported permeation rates may be affected by solvents, components, or impurities in munition grade or modified agents.

Because of the extreme dermal hazard posed by arsenic vesicants, responders should wear a Level A protective ensemble whenever there is a potential for exposure to any liquid agent, or to an elevated or unknown concentration of agent vapor.

Decontamination

General

Although the vesicant properties of arsenical agents can be eliminated during decontamination, arsenic is an element and cannot be destroyed. Residual arsenical compounds may still possess significant toxicity if they enter the body through ingestion, or broken, abraded, or lacerated skin (e.g., penetration of skin by debris).

Arsenic vesicants are rapidly hydrolyzed in water but a lack of solubility may slow the rate of reaction. Arsenic decomposition products are stable and some of them have toxic and/or vesicant properties that nearly equal the original agent.

Solubility of an agent will be decreased further if it is dissolved in an immiscible organic solvent or if it is thickened such that it forms a protective layer at the agent/water interface. Addition of solvents or mechanical mixing may be required to overcome insolubility problems.

These agents are readily destroyed by high pH (i.e., basic solutions), especially when used in combination with a strong oxidizing agent. For this reason, undiluted household bleach is an excellent agent for decontamination of these agents. Ensure that the bleach solution remains in contact with the agent for a minimum of 5minutes. However, a large excess will be need to ensure complete destruction of the agents. Lewisite (C04-A002) reacts with basic solutions, including household bleach, to produce acetylene gas.

Steam is an effective method of destroying arsenic vesicants. However, care must be taken to limit the spread of the agent and to guard against production of the toxic and potentially vesicating hydrolysis products (see hazardous decomposition products above).

Reactive oximes and their salts, such as potassium 2,3-butanedione monoximate found in commercially available reactive skin decontaminant lotion (RSDL), are extremely effective at rapidly detoxifying arsenic vesicants.

Vapors

Casualties/personnel

Speed in decontamination is absolutely essential. To be effective, decontamination must be completed within 2 minutes after exposure. Remove all clothing as it may continue to emit trapped agent vapor after contact with the vapor cloud has ceased. Shower using copious amounts of soap and water. Ideally, showers will be high volume with low pressure. Ensure that the hair has been washed and rinsed to remove potentially trapped vapor. If there is a potential that the eyes have been exposed to vesicants, irrigate with water or 0.9% saline solution for a minimum of 15 minutes.

Small areas

Ventilate to remove the vapors. If condensation is present, decontaminate with copious amounts of undiluted household bleach (see general section above). Allow it to stand for a minimum of 5 minutes before rinsing with water. Collect and place into containers lined with high-density polyethylene. Wash the area with copious amounts of the soap and water. Collect and containerize the rinseate. Removal of porous material, including painted surfaces, may be required because vesicants that have been absorbed into these materials can migrate back to the surface posing both a contact and vapor hazard.

Liquids, Solutions, or Liquid Aerosols

Casualties/personnel

Cover all open wounds during the decontamination process. Speed in decontamination is absolutely essential. To be effective, decontamination must be completed within 2 minutes after exposure. Remove all clothing immediately. Even clothing that has not come into direct contact with the agent may contain trapped vapor. To avoid further exposure of the head, neck and face to the agent, cut off potentially contaminated clothing that must be pulled over the head. Remove as much of the vesicant from the skin as fast as possible. If water is not immediately available, the agent can be absorbed with any convenient material such as paper towels, toilet paper, flour, or talc. To minimize both spreading the agent and abrading the skin, do not rub the agent with the absorbent. Blot the contaminated skin with the absorbent.

Use a sponge or cloth with liquid soap and copious amounts of water to wash the skin surface and hair at least three times. Ideally, showers will be high volume with low pressure. Do not delay decontamination to find warm or hot water if it is not readily available. Avoid rough scrubbing as this could abrade the skin and increase percutaneous absorption of residual agent. Rinse with copious amounts of water. If there is a potential that the eyes have been exposed to vesicants, irrigate with water or 0.9% saline solution for a minimum of 15 minutes.

Although the CDC does not recommend the use of hypochlorite bleach directly on skin for decontamination, the military still recognizes household bleach as an effective alternative to soap and water. The bleach solution should be no more than 0.5% sodium hypochlorite (i.e., no more than one-part household bleach in nine-parts water) to avoid damaging the skin. Avoid any contact with sensitive areas such as the eyes. Allow the bleach solution to remain in contact with the agent for a minimum of 5minutes. Rinse with copious amounts of water.

Small areas

Ventilate to remove the aerosol. Puddles of liquid can be contained by covering with absorbent material such as vermiculite, diatomaceous earth, clay, sponges, or towels. Place the absorbed material into containers lined with high-density polyethylene. Before sealing the container, cover the contents with undiluted household bleach (see general section above). If lewisite (C04-A002) is present, flammable acetylene gas will be generated during the neutralization process. Take appropriate actions to disperse the vapors. Decontaminate the area with copious amounts of the neutralizing agent. Allow it to stand for a minimum of 5minutes before rinsing with water. Collect and containerize the rinseate. Ventilate the area to remove residual vapors. Removal of porous material, including painted surfaces, may be required because vesicants that have been absorbed into these materials can migrate back to the surface posing both a contact and vapor hazard.

MEDICAL

CDC Case Definition

1) A case in which an arsenic vesicant is detected in biologic samples. OR 2) Detection of vesicants in environmental samples. The case can be confirmed if laboratory testing is not performed by either the presence of a predominant amount of clinical and nonspecific laboratory evidence or an absolute certainty of the etiology of the agent.

Differential Diagnosis

The following factors have been suggested as alternatives to consider when presented with a potential case of exposure to vesicant agents: chemical burns from contact with strong acids or bases; barbiturates, chemotherapeutic agents, carbon monoxide; reactions to drugs producing

Stevens-Johnson syndrome, toxic epidermal necrolysis, or both; autoimmune diseases such as bullous pemphigoid and pemphigus vulgaris; and staphylococcus scalded skin syndrome.

Signs and Symptoms

Vapors/Aerosols

Exposure of the eyes to even small amounts of arsenic vesicant vapor produces immediate tearing, pain and involuntary blinking (blepharospasm). Eye symptoms are rapidly followed by coughing, sneezing, and vomiting. Other upper respiratory signs vary with the amount of exposure and include scratchy throat, laryngitis, and a feeling of shortness of breath. High exposures may result in low blood pressure (hypotension).

Exposure of the skin to arsenic vesicants produces an immediate burning sensation. Reddening of the skin (erythema) may appear in as short a time as 5minutes although full progression to blisters may not develop for up to 18 hours. Although blisters tend to be deeper and more painful than produced by sulfur vesicants (C03), they heal more readily.

Liquids

Arsenic vesicants produce an immediate burning sensation. Reddening of the skin (erythema) may appear in as short a time as 5 minutes although full progression to blisters may not develop for up to 18 hours. Although blisters tend to be deeper and more painful than produced by sulfur vesicants (C03), they heal more readily.

These agents rapidly permeate through the skin. Extensive skin contamination can damage susceptible tissue including blood cells and the liver. Casualties may develop signs of systemic arsenic toxicity including diarrhea, damage to the liver, kidneys, nervous system, red blood cells, and the brain.

Mass-Casualty Triage Recommendations

Priority 1

A casualty with mild to moderate pulmonary effects less than 6 hours post exposure or with moderately severe or severe pulmonary signs and symptoms after 6 hours post-exposure.

Priority 2 (majority of cases)

A casualty with skin lesions covering between 5 and 50% of the body surface area (BSA), a casualty with mild to moderate pulmonary effects after 6 hours post-exposure or a casualty with eye injuries.

Priority 3

A casualty with skin lesions covering less than 5% of the BSA, or a casualty with eye irritation or reddening, and/or slight upper respiratory complaints such as hacking cough or irritated throat 12 or more hours post-exposure.

Priority 4

A casualty with skin lesions from *liquid exposure* to more than 50% of the BSA, or a casualty with severe pulmonary effects less than 6 hours post-exposure.

Casualty Management

Decontaminate the casualty ensuring that all the vesicant has been removed. Rapid decontamination of any exposure is essential. If vesicants have gotten into the eyes, irrigate the eyes with

water or 0.9% saline solution for at least 15 minutes. BAL (British-anti-Lewisite, dimercaprol) solution or ophthalmic ointment may be beneficial if administered promptly. Irrigate open wounds with water or 0.9% saline solution for at least 10 minutes.

Once the casualty has been decontaminated, including the removal of foreign matter from wounds, medical personnel do not need to wear a chemical-protective mask.

If a casualty is known to have inhaled vesicant vapors but does not display any signs or symptoms of an impacted airway, it may still be appropriate to intubate the casualty since laryngeal spasms or edema may make it difficult or impossible later. Reddening of the skin (erythema) and lesions are treated symptomatically.

BAL is the standard treatment for poisoning by arsenic compounds and will alleviate some effects from exposure to arsenic vesicants. It may also decrease the severity of skin and eye lesions if applied topically within minutes after decontamination is complete (i.e., within 2 to 5 minutes post-exposure). Additional chelating agents for treatment of systemic arsenic toxicity include meso-2,3-dimercaptosuccinic acid (DMSA) and 2,3-dimercapto-1-propanesulfonic acid (DMPS).

Asymptomatic individuals suspected of exposure to vesicants should be kept under observation for at least 8 hours.

Burns from *liquid exposure* to over 50% of the body surface suggests that the individual has absorbed more than a lethal dose of vesicant and the prognosis for survival of the individual is poor.

FATALITY MANAGEMENT

Remove all clothing and personal effects segregating them as either durable or non-durable items. While it may be possible to decontaminate durable items, it may be safer and more efficient to destroy non-durable items rather than attempt to decontaminate them. Items that will be retained for further processing should be double sealed in impermeable containers, ensuring that the inner container is decontaminated before placing it in the outer one.

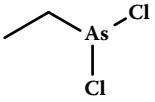
Vesicants that have entered the body are metabolized, hydrolyzed, or bound to tissue and pose little threat of off-gassing. To remove agents on the outside of the body, wear appropriate respiratory and dermal protective clothing while washing the remains with a 2% sodium hypochlorite bleach solution (i.e., 2 liters of water for every liter of household bleach), ensuring the solution is introduced into the ears, nostrils, mouth and any wounds. This concentration of bleach will not affect remains but will neutralize arsenic vesicant agents. Higher concentrations of bleach can harm remains. Pay particular attention to areas where agent may get trapped, such as hair, scalp, pubic areas, fingernails, folds of skin, and wounds. The bleach solution should remain on the cadaver for a minimum of 15 minutes. Wash with soap and water. Ensure that all the bleach solution is removed prior to embalming as it will react with embalming fluid. All wash and rinse waste must be contained for proper disposal. Screen the remains for agent vapors and residual liquid at the conclusion of the decontamination process. If the remains must be stored before embalming, then place them inside body bags designed to contain contaminated bodies or in two body bags. If two body bags are used, seal the inner bag with duct tape, rinse, and then place in the second bag. After embalming is complete, place the remains in body bags designed to contain contaminated bodies or in two body bags. Body fluids removed during the embalming process do not pose any additional risks and should be contained and handled according to established procedures.

Standard burials are acceptable when contamination levels are low enough to allow bodies to be handled without wearing additional protective equipment. Cremation may be required if remains cannot be completely decontaminated. Although arsenic vesicant agents are destroyed at the operating temperature of a commercial crematorium (i.e., above 1,000°F), the initial heating phase may volatilize some of the agent and allow vapors to escape. Additionally, combustion will produce toxic and potentially volatile arsenic oxides.

C04-A AGENTS

C04-A001

Ethyl Dichloroarsine (Agent ED)
CAS: 598-14-1
RTECS: CH3500000
UN: 1183; 139 (As a weapon: 1892; 151)
EC: 209-919-3
UNII: 4Z7627500U
ICD-11: XM1AE2



C_2 H_5 As Cl_2

Clear, colorless to yellowish, somewhat oily liquid that has a fruity but biting and irritating odor that is detectable at ≥0.14 ppm. Vapor is irritating to both eyes and skin. Vapor concentrations that will produce blisters are hard to obtain in an open area. Predominately acts as a vomiting agent. Blistering is usually caused by contact with liquid agent.

Also reported as a mixture with Bis(chloromethyl) ether (C10-A011).

Exposure Hazards
Conversion Factor: 1 ppm = 7.15 mg/m^3 at 77°F
$LCt_{50\ (Inh)}$: 3,000 mg-min/m^3 (210 ppm for a 2-minute exposure)
$ICt_{50\ (Inh)}$: 5 – 10 mg-min/m^3 (0.4 – 0.7 ppm for a 2-minute exposure)

These values are from older sources (circa 1952) and are not supported by modern data. No updated toxicity estimates have been proposed.

$MEG_{(1hr)}$: Neg: 0.0032 ppm; Mar: 0.0040 ppm; Crit: 0.012 ppm; Cat: —
PAC-1: 0.00036 ppm; *PAC-2:* 0.0041 ppm; *PAC-3:* 0.012 ppm

Interim AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 0.0041 ppm; other levels Not Developed
AEGL-3: 1 hr – 0.012 ppm; other levels Not Developed

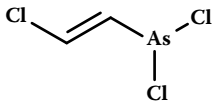
Properties:

MW: 174.9	*VP:* 2.29 mmHg	*FlP:* —
D: 1.7 g/mL (57°F)	*VD:* 6.0	*LEL:* —
MP: –85°F	*Vlt:* 3,060 ppm	*UEL*: —
BP: Decomposes	*ER:* —	*RP:* 4
Vsc: —	*H_2O:* Slight (slowly decomposes)	*IP:* <10 eV
	Sol: Acetone, alcohols, hydrocarbons	

C04-A002

Lewisite (Agent L)
CAS: 541-25-3
RTECS: CH2975000

UN: —
EC: —
UNII: 82TOY8U2KD
ICD-11: XM1BL4



C_2 H_2 As Cl_3

Colorless to brown oily liquid that is odorless when pure. Crude material may have a violet to purple color. Impurities give it an odor similar to geranium that is detectable at ≥0.9 ppm. There are two configurational isomers of this agent that have been studied.

Undergoes considerable decomposition when explosively disseminated. Rapidly decomposes in high humidity forming 2-chlorovinylarsenious oxide (C04-D-008), which is also a strong vesicant.

Also reported as a mixture with sulfur mustard (C03-A001).

Exposure Hazards

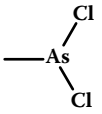
Conversion Factor: 1 ppm = 8.48 mg/m^3 at 77°F
$LCt_{50\ (Inh)}$: 1,000 mg-min/m^3 (59 ppm for a 2-minute exposure)
$LCt_{50\ (Per)}$: <85°F: 5,000–10,000 mg-min/m^3 (20–40 ppm for a 30-minute exposure)
$LCt_{50\ (Per)}$: >85°F: 2,500–5,000 mg-min/m^3 (10–20 ppm for a 30-minute exposure)
LD_{50}: 1.4 g
$ICt_{50\ (Skin)}$: <85°F: 500 mg-min/m^3 (2 ppm for a 30-minute exposure)
$ICt_{50\ (Skin)}$: >85°F: 200 mg-min/m^3 (0.8 ppm for a 30-minute exposure)
$ICt_{50\ (Eyes)}$: 75 mg-min/m^3 (4.4 ppm for a 2-minute exposure)
These are provisional updates from older values that have not been formally adopted.
Eye Irritation: 1.5 ppm for a 2-minute exposure
$MEG_{(1hr)}$: Neg: 0.00035 ppm; Mar: 0.014 ppm; Crit: 0.050 ppm; Cat: 0.15 ppm
PAC-1: 0.0027 ppm; *PAC-2:* 0.029 ppm; *PAC-3:* 0.087 ppm
WPL AEL: 4×10^{-4} ppm
GPL AEL: 4×10^{-4} ppm
IDLH: 0.042 ppm (established for Pine Bluff arsenals non stockpile demilitarization operations in 2009)
Final AEGLs (with or without mixtures of L2 and L3)
AEGL-1: Not Developed
AEGL-2: 1 hr – 0.029 ppm; 4 hr – 0.0083 ppm; 8 hr – 0.0044 ppm
AEGL-3: 1 hr – 0.087 ppm; 4 hr – 0.025 ppm; 8 hr – 0.013 ppm

Properties:

MW: 207.3	*VP:* 0.35 mmHg (77°F)	*FlP:* NA
D: 1.9 g/mL (77°F)	*VD:* 7.1	*LEL:* NA
MP: 29°F	*Vlt:* 460 ppm (est.)	*UEL*: NA
MP: –49°F (munitions grade)	*ER:* —	*RP:* 20 (77°F)
BP: Decomposes	*H_2O:* Insoluble (reacts)	*IP:* <10.6 eV
Vsc: 1.1 cS (77°F)	*Sol:* Most organic solvents	

C04-A003

Methyl Dichloroarsine (Agent MD)
CAS: 593-89-5
RTECS: CH4375000
UN: —
EC: —
UNII: —
ICD-11: —



C H_3 As Cl_2

Odorless liquid. Vapor is irritating to both eyes and skin, and is detectable at ≥0.1 ppm.

Exposure Hazards

Conversion Factor: 1 ppm = 6.58 mg/m^3 at 77°F
$LCt_{50\ (Inh)}$: 3,000–5,000 mg-min/m^3 (230–380 ppm for a 2-minute exposure). This toxicity estimate is from an older source (circa 1952) and has not been updated. Current sources do not provide an estimate on a lethal concentration.
$ICt_{50\ (Inh)}$: 25 mg-min/m^3 (1.9 ppm for a 2-minute exposure). This is a provisional update from an older value (circa 1956) that has not been formally adopted.
$MEG_{(1hr)}$: Neg: —; Mar: 0.0081 ppm; Crit: 0.024 ppm; Cat: —
PAC-1: 0.00073 ppm; *PAC-2:* 0.0080 ppm; *PAC-3:* 0.024 ppm

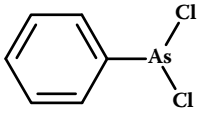
Interim AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 0.008 ppm; 4 hr – 0.0023 ppm; 8 hr – 0.00096 ppm
AEGL-3: 1 hr – 0.024 ppm; 4 hr – 0.0067 ppm; 8 hr – 0.0029 ppm

Properties:

MW: 160.9	*VP:* 7.593 mmHg	*FlP:* —
D: 1.8 g/mL	*VD:* 5.5	*LEL:* —
MP: –67°F	*Vlt:* 10,000 ppm	*UEL*: —
BP: 271°F	*ER:* —	*RP:* 0.8
Vsc: —	*H_2O:* Reacts	*IP:* 10.4 eV
	Sol: Most organic solvents	

C04-A004

Phenyl Dichloroarsine (Agent PD)
CAS: 696-28-6
RTECS: CH5425000
UN: —
EC: 211-791-9
UNII: KK93BBF49U
ICD-11: —



$C_6 H_5 As Cl_2$

Colorless to yellow odorless liquid. Vapor is irritating to the nose and throat, and is detectable at ≥0.1 ppm.

Also reported as a mixture with sulfur mustard (C03-A001); diphenylchloroarsine (C14-A001); N-Ethylcarbazole (C13-A022); arsenic trichloride (C04-C006).

Exposure Hazards

Conversion Factor: 1 ppm = 9.12 mg/m^3 at 77°F
$LCt_{50\ (Inh)}$: 2,600 mg-min/m^3 (140 ppm for a 2-minute exposure)
$ICt_{50\ (Skin)}$: 200–500 mg-min/m^3 (0.7–1.8 ppm for a 30-minute exposure)
Intolerable Irritation: 0.9 ppm for a 2-minute exposure

These are provisional updates from older values (circa 1952) that have not been formally adopted.

$MEG_{(1hr)}$: Neg: —; Mar: 0.0067 ppm; Crit: 0.020 ppm; Cat: —
PAC-1: 0.00060 ppm; *PAC-2:* 0.0067 ppm; *PAC-3:* 0.020 ppm

Interim AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 0.016 mg/m^3; other levels Not Developed
AEGL-3: 1 hr – 0.18 mg/m^3; other levels Not Developed

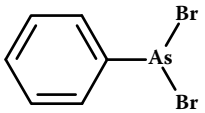
Properties:

MW: 222.9	*VP:* 0.033 mmHg (77°F)	*FlP:* —
D: 1.7 g/mL	*VD:* 7.7	*LEL:* —
MP: –9°F	*Vlt:* 43 ppm	*UEL:* —
BP: 451°F	*ER:* —	*RP:* 200
Vsc: 2.0 cS (77°F)	*H_2O:* 0.6% (rapidly decomposes)	*IP:* <9 eV
	Sol: Alcohols, gasoline, acetone, ether	

C04-A005

Phenyl Dibromoarsine

CAS: 696-24-2
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_6 H_5 As Br_2$

Colorless to faintly yellow liquid.

Exposure Hazards

Conversion Factor: 1 ppm = 12.75 mg/m^3 at 77°F

$LC_{50\ (Inh)}$: 200 mg/m^3 (16 ppm) for a 10-minute exposure. This toxicity estimate is from an older source (circa 1937) and has not been updated.

Properties:

MW: 311.8	*VP:* —	*FlP:* 235°F
D: 2.1 g/mL (59°F)	*VD:* 11	*LEL:* —
MP: 100°F (est.)	*Vlt:* —	*UEL:* —
BP: Decomposes	*ER:* —	*RP:* —
Vsc: —	H_2O: Insoluble	*IP:* —
	Sol: —	

C04-C COMPONENTS AND PRECURSORS

C04-C006

Arsenic Trichloride

CAS: 7784-34-1

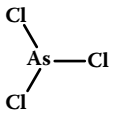
RTECS: CG1750000

UN: 1560; 157

EC: 232-059-5

UNII: 5XW39M1300

ICD-11: —



As Cl_3

Colorless oily liquid with an acrid odor. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. It causes severe irritation and burns to the eyes, mucous membranes, and skin; cough, chest pain, and accumulation of fluid in the lungs (pulmonary edema).

Used in the ceramics industry and as a chemical intermediate for arsenic pharmaceuticals and arsenic insecticides.

This material is on Schedule 2 of the CWC, the Australia Group Export Control list, the DHS Chemicals of Interest list and the ITF-25 Low Threat list.

This material is a general precursor for arsenical vesicants and many vomiting/sternatory agents (C14).

Exposure Hazards

Conversion Factor: 1 ppm = 7.41 mg/m^3 at 77°F

$MEG_{(1hr)}$: Neg: 0.20 ppm; Mar: 1.3 ppm; Crit: 10 ppm; Cat: —

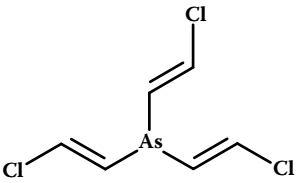
PAC-1: 0.12 ppm; *PAC-2:* 1.3 ppm; *PAC-3:* 32 ppm

Properties:

MW: 181.3	*VP:* 10 mmHg (74°F)	*FlP:* NA
D: 2.2 g/mL	*VD:* 6.3	*LEL:* NA
MP: 17°F	*Vlt:* 13,000 ppm	*UEL*: NA
BP: 267°F	*ER:* —	*RP:* 0.75
Vsc: 0.53 cS	H_2O: Reacts	*IP:* 10.55 eV
	Sol: Chloroform, oils, ether	

C04-C007

Lewisite 3 (Agent L3)
CAS: 40334-70-1
RTECS: —
UN: —
EC: —
UNII: EA66378A4W
ICD-11: —



$C_6 H_6 As Cl_3$

Specific information on physical appearance is not available for this material.

This material is on Schedule 1 of the CWC.

This material is easily converted to lewisite (C04-A002) and lewisite 2 (C14-A004). It is also commonly found as an impurity and degradation product in lewisite.

Exposure Hazards

Conversion Factor: 1 ppm = 10.61 mg/m^3 at 77°F

Based on available information, this material appears to have few, if any, acute vesicant or vomiting/sternatory properties.

$MEG_{(1hr)}$: Neg: —; Mar: 0.12 mg/m^3; Crit: 0.74 mg/m^3; Cat: —
PAC-1: 0.023 mg/m^3; *PAC-2:* 0.25 mg/m^3; *PAC-3:* 0.74 mg/m^3

Proposed AEGLs

AEGLs have been proposed only for mixtures of this compound with Lewisite (C04-A002).

Properties:

MW: 259.4	*VP:* 0.0112 mmHg (77°F)	*FlP:* 264°F
D: 1.6 g/cm^3	*VD:* 8.9	*LEL:* —
MP: 71°F	*Vlt:* 15 ppm	*UEL*: —
BP: Decomposes	*ER:* —	*RP:* 560
Vsc: —	H_2O: Insoluble	*IP:* —
	Sol: Common organic solvents except alcohol	

C04-D DECOMPOSITION PRODUCTS AND IMPURITIES

C04-D008

2-Chlorovinylarsenious Oxide (L-Oxide)

CAS: 3088-37-7

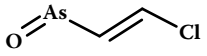
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



C_2 H_2 As Cl O

White crystalline powder. Produced by the reaction of lewisite (C04-A002) with water. Resistant to further hydrolysis and persistent in the environment.

Exposure Hazards

Conversion Factor: 1 ppm = 6.23 mg/m^3 at 77°F

Highly toxic with significant vesicant properties.

Properties:

MW: 152.4	*VP:* —	*FlP:* —
D: —	*VD:* —	*LEL:* —
MP: 289°F	*Vlt:* —	*UEL:* —
BP: —	*ER:* —	*RP:* —
Vsc: —	*H_2O:* 1%	*IP:* —
	Sol: —	

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5 Urticants

GENERAL INFORMATION

The agents in this class are halogenated oximes. This class of agents is not specifically covered by the Chemical Weapons Convention. Because of the toxicity of the agents and lack of commercial application outside of limited scientific research, urticants would be prohibited base on the Guidelines for Schedules of Chemicals.

These materials were developed shortly after World War I. They are moderately difficult to synthesize and disperse.

Chloroformoxime, the first urticant, was first synthesized in 1894. The more effective dihaloformoximes – phosgene oxime (C05-A001), dibromoformoxime (C05-A002), and diiodoformoxime (C05-A003) – were prepared in the late 1920s and early 1930s. Phosgene oxime was stockpiled by Nazi Germany during World War II but was never used. Since the end of World War II, urticants have been evaluated by numerous countries but stockpiled by few because of production, weaponization, and storage issues. The former Soviet Union overcame these issues and did stockpile phosgene oxime. Urticants have never been used on the battlefield.

TOXICOLOGY

Effects

Urticants produce instant, almost intolerable pain and cause immediate local destruction of skin and mucous membranes. No other chemical agent produces such an immediately painful onset followed by rapid tissue death. Sensations caused by exposure to these agents range from mild prickling to almost intolerable pain resembling a severe bee sting. Effects depend on the concentration of the agent and the length of the exposure. Tissue damage is more severe than produced by vesicants (C03, C04). Direct contact of the agent with the skin produces a corrosive type lesion similar to those produced by a strong acid. Skin lesions may not fully heal for 1 to 3 months.

Eyes are especially susceptible to urticants. In addition to immediate pain, urticants produce lesions and inflammation the cornea (keratitis), which may progress to blindness.

Inhalation of urticants can cause lung membranes to swell and become filled with liquid (pulmonary edema). Death may result from lack of oxygen.

Urticants are also systemic agents and rapidly pass through the skin to affect susceptible tissue. Percutaneous absorption of liquids or solids can also produce pulmonary edema and blood clots in the lungs.

Pathways and Routes of Exposure

Urticants are hazardous through any route of exposure including inhalation, skin and eye exposure, ingestion, and broken, abraded, or lacerated skin (e.g., penetration of skin by debris).

General Exposure Hazards

Urticants have a penetrating and disagreeable odor detectable at very low concentrations. Even minimal exposure causes immediate irritation and pain of the eyes, nose, mucous membranes, respiratory system, and skin. Urticants pose a significant percutaneous hazard and are absorbed through the skin within seconds.

DOI: 10.4324/9781003230571-7

Lethal concentrations (LC_{50}s) for inhalation of these agents are as low as 340 parts per million for a 2-minute exposure.

Lethal percutaneous exposures (LD_{50}s) to liquid are estimated to be less than two grams per individual.

Incapacitating concentrations (ICt_{50}) for dermal exposure to these agents are as low as 0.3 parts per million for a 2-minute exposure.

The rate of detoxification of these agents by the body is not known. However, because of the cellular damage caused by these agents, exposures have a cumulative risk.

Latency Period

Urticants produce immediate irritation and pain of the eyes, respiratory tract, and skin. Blanching, reddening of the skin (erythema), and hives develop within minutes of exposure. Blisters, localized tissue death (necrosis) and formation of scabs may be delayed for 24 hours or more. Systemic effects, including pulmonary edema, from either inhalation or percutaneous absorption of the agent, do not occur until after a substantial latency period.

CHARACTERISTICS

Physical Appearance/Odor

Laboratory Grade

Laboratory grade agents are typically colorless crystalline solids. They have intense, penetrating, and disagreeable odors detectable at very low levels.

Munition Grade

Munition grade agents are typically amber to dark brown liquids. As the agent ages and decomposes, it continues to discolor until it may appear black. Odors are intense, penetrating, disagreeable, and violently irritating.

Stability

Urticants are relatively unstable and tend to decompose spontaneously unless stored at low temperatures. Below –4°F, they can be kept for extended periods. Solvents including 1,2-dimethoxybenzene, ether, dioxane, nitromethane, and glycine act as stabilizers and may be added to help prevent decomposition of agents during storage. Agents can be stored in glass or enamel-lined containers. Urticants rapidly attack rubber and metals, especially iron.

Persistency

For military purposes, unmodified urticants are classified as nonpersistent. They decompose rapidly in soil, and after a shot delay on most other surfaces and in water.

Urticants, even solids, have relatively high vapor pressures and evaporation or sublimation rates are nearly the same as water.

Environmental Fate

Urticant vapors have a density greater than air and tend to collect in low places. Porous material, including painted surfaces, will absorb both liquid and gaseous agent. After the initial surface contamination has been removed, agent that has been absorbed into porous material can migrate

back to the surface posing both a contact and vapor hazard. Urticants can penetrate clothing and rubber faster than other chemical warfare agents. Clothing may emit trapped agent vapor for up to 30 minutes after contact with a vapor cloud.

Urticants are unstable and decompose rapidly in soil. Agents dissolve slowly but completely in water and may take days to decompose once in solution. The specific gravities of unmodified liquid agents are greater than that of water. These agents are also soluble in most organic solvents including gasoline and oils.

ADDITIONAL HAZARDS

Exposure

The rapid skin damage caused by urticants renders the skin more susceptible to subsequent exposure of any other toxic material or agent.

All foodstuffs in the area of a release should be considered contaminated. Unopened items packaged in glass, metal, or heavy-duty plastic and exposed only to agent vapors may be used after decontamination of the container. Unopened items exposed to liquid or solid agents should be decontaminated within a few hours post-exposure or destroyed. Opened or unpackaged items, or those packaged only in paper or cardboard, should be destroyed.

Meat, milk, and animal products from animals exposed to or killed by urticants should be destroyed or quarantined until it has been tested and determined to be safe to consume.

Plants, fruits, vegetables, and grains should be quarantined until tested and determined to be safe to consume.

Livestock/Pets

Animals can be decontaminated with shampoo/soap and water (see the decontamination section below). If the animal's eyes have been exposed to agent, they should be irrigated with water or saline solution for a minimum of 30 minutes.

Unprotected feedstock (e.g., hay or grain) should be destroyed. Although leaves of forage vegetation could still retain sufficient urticants to produce effects for a limited time, urticants are relatively nonpersistent on surfaces and should rapidly decompose depending on the level of contamination and the weather conditions.

Fire

Heat from a fire will increase the amount of agent vapor in the area. A significant amount of the agent could be volatilized and escape into the surrounding environment before it is consumed by the fire. Urticants are soluble in water and actions taken to extinguish the fire can also spread the agent. Runoff from firefighting efforts will pose a significant threat. A solution containing as little as 8% of active agent can cause pain within seconds of exposure. Potential decomposition products include toxic and/or corrosive gases.

Reactivity

Urticants rapidly react with metals, especially iron. Iron chloride, even in trace amounts, can cause explosive decomposition. These agents decompose slowly when dissolved in water. Dilute acids will retard the rate of decomposition.

Urticants react violently with strong bases. Reaction with household bleach may produce toxic gases.

Hazardous Decomposition Products

Hydrolysis

Urticants produce hydrogen chloride (HCl), hydrogen bromide (HBr) or hydrogen iodide (HI), and hydroxlamines when hydrolyzed.

Combustion

Volatile decomposition products may include hydrogen chloride (HCl), hydrogen bromide (HBr), hydrogen iodide (HI), nitrogen oxides (NO_x), and toxic dimerization products.

PROTECTION

Evacuation Recommendations

Isolation and protective action distances listed below are taken from the 2020 Emergency Response Guidebook. CX is the only urticant addressed and recommendations are based on a release scenario involving direct aerosolization of the solid agent with a particle size between 2 and 10 microns. A small release of CX involves 10 kilograms (approximately 6 liters) of bulk agent and a large release involves 25 kilograms (approximately 150 liters) of bulk agent.

CX (Phosgene Oxime) *C05-A001*

	Initial Isolation	Downwind Day	Downwind Night
Small device (10 kg)	60 m	0.2 km	1.1 km
Large device (25 kg)	200 m	1.2 km	5.1 km

Personal Protective Requirements

Structural Firefighters' Gear

Urticants can penetrate garments and rubber much faster than other chemical warfare agents. Structural firefighters' protective clothing is recommended for fire situations only; it is not effective in spill situations or release events and should never be used as the primary chemical protective garment to enter an area contaminated with urticants.

Respiratory Protection

Self-contained breathing apparatuses (SCBAs) or air purifying respirators (APRs) should have a National Institute for Occupational Safety and Health (NIOSH) Chemical/Biological/Radiological/Nuclear (CBRN) certification since urticants can be absorbed into or degrade the materials used to make some respirators. However, during emergency operations, other NIOSH-approved SCBAs or APRs that have been specifically tested by the manufacturer against chemical warfare agents may be used if deemed necessary by the incident commander. APRs should be equipped with a NIOSH-approved CBRN filter or a combination organic vapor/acid gas/particulate cartridge.

Immediately dangerous to life or health (IDLH) levels are the ceiling limit for respirators other than SCBAs. However, IDLH levels have not been established for urticants. Therefore, any potential exposure to these agents should be regarded with extreme caution and the use of SCBAs for respiratory protection should be considered.

Chemical Protective Clothing

Currently, there is no information on performance testing of chemical protective clothing against urticants.

Because of the extreme dermal hazard posed by urticants, responders should wear a Level A protective ensemble whenever there is a potential for exposure to any solid or liquid agent, or to an elevated or unknown concentration of agent vapor.

Decontamination

General

Urticants are very soluble in water and can be removed from most surfaces by washing with soap and water.

Solubility of an agent will be decreased if it is dissolved in an immiscible organic solvent. The addition of solvents or mechanical mixing may be required to overcome insolubility problems.

Because of the vigorous reaction of urticants with caustics, household bleach is not an effective decontamination agent for large quantities of these materials. Reaction with hypochlorites, including household bleach, may produce toxic gases such as chlorine.

Vapors

Casualties/personnel

Speed in decontamination is absolutely essential. Because of the rapid onset of effects and the speed with which urticants are absorbed through the skin, decontamination will not be entirely effective by the time the casualty experiences pain and blanching begins to occur. However, decontamination must still be done as rapidly as possible post-exposure.

Remove all clothing as it may continue to emit trapped agent vapor after contact with the vapor cloud has ceased. Shower using copious amounts of soap and water. Ideally, showers will be high volume with low pressure. Ensure that the hair has been washed and rinsed to remove potentially trapped vapor. To be effective, decontamination must be completed within 2minutes of exposure. If there is a potential that the eyes have been exposed to urticants, irrigate with water or 0.9% saline solution for a minimum of 15 minutes.

Small areas

Ventilate to remove the vapors. If condensation is present, decontaminate the area with copious amounts of soap and water. Collect the agent and rinseate and place into containers lined with high-density polyethylene. Although urticants rapidly break down on most surfaces, removal of porous material, including painted surfaces, may be required to prevent agents that has been absorbed into these materials from migrating back to the surface and posing an extended hazard.

Liquids, Solutions, or Liquid Aerosols

Casualties/personnel

Speed in decontamination is absolutely essential. Because of the rapid onset of effects and the speed with which urticants are absorbed through the skin, decontamination will not be entirely effective by the time the casualty experiences pain. However, decontamination must still be done as rapidly as possible post-exposure.

Cover all open wounds during the decontamination process. Remove all clothing immediately. Even clothing that has not come into direct contact with the agent may contain trapped vapor. To avoid further exposure of the head, neck and face to the agent, cut off potentially contaminated clothing that must be pulled over the head. Remove as much of the urticant from the skin as fast as possible. If water is not immediately available, the agent can be absorbed with any convenient material such as paper towels, toilet paper, flour, talc, etc. To minimize both spreading the agent

and abrading the skin, do not rub the agent with the absorbent. Blot the contaminated skin with the absorbent.

Use a sponge or cloth with liquid soap and copious amounts of water to wash the skin surface and hair at least three times. Ideally, showers will be high volume with low pressure. Do not delay decontamination to find warm or hot water if it is not readily available. Avoid rough scrubbing as this could abrade the skin and increase percutaneous absorption of residual agent. Rinse with copious amounts of water. If there is a potential that the eyes have been exposed to urticants, irrigate with water or 0.9% saline solution for a minimum of 1 hour.

Small areas

Ventilate to remove the aerosol. Puddles of liquid can be contained by covering with absorbent material such as vermiculite, diatomaceous earth, clay, sponges, or towels. Place the absorbed material into containers lined with high-density polyethylene. Decontaminate the area with copious amounts of soap and water. Collect and containerize the rinseate. Ventilate the area to remove residual vapors. Although urticants rapidly break down on most surfaces, removal of porous material, including painted surfaces, may be required to prevent agents that has been absorbed into these materials from migrating back to the surface and posing an extended hazard.

Solids or Particulate Aerosols

Casualties/personnel

Speed in decontamination is absolutely essential. Because of the rapid onset of effects and the speed with which urticants are absorbed through the skin, decontamination will not be entirely effective by the time the casualty experiences pain. However, decontamination must still be done as rapidly as possible post-exposure.

Cover all open wounds during the decontamination process. Do not attempt to brush the agent off of the individual or their clothing as this can aerosolized the agent. If possible, dampen the agent with a water mist to help prevent aerosolization. Remove all clothing immediately. To avoid further exposure of the head, neck, and face to the agent, cut off potentially contaminated clothing that must be pulled over the head. Wash the skin surface and hair at least three times with copious amounts of soap and water. Ideally, showers will be high-volume with low-pressure. Do not delay decontamination to find warm or hot water if it is not readily available. Avoid rough scrubbing as this could abrade the skin and increase percutaneous absorption of residual agent. Rinse with copious amounts of water. If there is a potential that the eyes have been exposed to vesicants, irrigate with water or 0.9% saline solution for a minimum of 1 hour.

Small areas

If indoors, close windows and doors in the area and turn off anything that could create air currents (e.g., fans, air conditioner, etc.). Allow aerosol to settle. Dampen agent with water until thoroughly wet. Cover with absorbent material such as vermiculite, diatomaceous earth, clay, sponges, or towels. Place the absorbed material into containers lined with high-density polyethylene. Repeat as necessary until the visible agent has been containerized. Decontaminate the area with copious amounts of soap and water. Collect and containerize the rinseate. Ventilate the area to remove vapors. Although urticants rapidly break down on most surfaces, removal of porous material, including painted surfaces, may be required to prevent agents that has been absorbed into these materials from migrating back to the surface and posing an extended hazard.

MEDICAL

CDC Case Definition

The CDC has not published a specific case definition for intoxication by urticants.

Differential Diagnosis

The following factors have been suggested as alternatives to consider when presented with a potential case of exposure to urticants: chemical burns from contact with strong acids or bases; barbiturates, chemotherapeutic agents, carbon monoxide; reactions to drugs producing Stevens-Johnson Syndrome, toxic epidermal necrolysis, or both; autoimmune diseases such as Bullous pemphigoid and Pemphigus vulgaris; and staphylococcus scalded skin syndrome.

Signs and Symptoms

Vapors/Aerosols

Urticant vapors are violently irritating to the eyes, nose, and respiratory tract, and cause immediate pain. Very low concentrations can cause inflammation, lacrimation, and temporary blindness; higher concentrations can cause corneal corrosion and dimming of vision. Inhalation causes runny nose, hoarseness, and sinus pain.

Agent vapor produces pain on exposed skin within a few seconds. Within 30 seconds post-contact,the exposed skin becomes white and is surrounded by an area of erythema (reddening of the skin). In approximately 15 minutes, exposed skin develops hives. After 24 hours, the skin in the central blanched area becomes brown and dies. A scab is formed in a few days although pus continues to discharge from the lesion. Healing is accompanied by sloughing of the scab; itching and pain may be present throughout healing.

Liquids/Solids

Contact with the skin produces pain within a few seconds. Within 30 seconds post-contact, exposed skin becomes white and is surrounded by a red ring resembling a wagon wheel. Within an hour, the area becomes swollen and within 24 hours the lesions turn yellow and form blisters. The skin then turns brown and dies. A scab is formed in a few days although pus continues to discharge from the lesion. Healing is accompanied by sloughing of the scab; itching and pain may be present throughout healing.

Urticants absorbed through the skin can cause pulmonary edema.

Mass-Casualty Triage Recommendations

Priority 1

A casualty with necrotic lesions and pain with early onset of airway damage.

Priority 2 (majority of cases)

A casualty with necrotic lesions and pain without further complications.

Priority 3

Not applicable for this class of agents.

Priority 4

Not applicable for this class of agents

Casualty Management

Decontaminate the casualty ensuring that all the urticant has been removed. Rapid decontamination of any exposure is essential. If urticants have gotten into the eyes, irrigate the eyes with water or 0.9% saline solution for at least 1 hour. Irrigate open wounds with water or 0.9% saline solution for at least 10 minutes.

Once the casualty has been decontaminated, including the removal of foreign matter from wounds, medical personnel do not need to wear a chemical-protective mask.

There is no antidote for exposure to these agents. Treatment consists of symptomatic management of lesions. Eye lesions should be treated by saline irrigation and coating the follicular margins with petroleum jelly to prevent sticking.

FATALITY MANAGEMENT

Remove all clothing and personal effects segregating them as either durable or non-durable items. While it may be possible to decontaminate durable items, it may be safer and more efficient to destroy non-durable items rather than attempt to decontaminate them. Items that will be retained for further processing should be double sealed in impermeable containers, ensuring that the inner container is decontaminated before placing it in the outer one.

Urticants that have entered the body are metabolized, hydrolyzed, or bound to tissue and pose little threat of off-gassing. To remove agents on the outside of the body, wear appropriate respiratory and dermal protective clothing while washing the remains with soap and water, ensuring the solution is introduced into the ears, nostrils, mouth, and any wounds. Pay particular attention to areas where agent may get trapped, such as hair, scalp, pubic areas, fingernails, folds of skin, and wounds. All wash and rinse waste must be contained for proper disposal.

Screen the remains for agent vapors and residual liquid at the conclusion of the decontamination process. If the remains must be stored before embalming, then place them inside body bags designed to contain contaminated bodies or in double body bags. If double body bags are used, seal the inner bag with duct tape, rinse, then place in the second bag. After embalming is complete, place the remains in body bags designed to contain contaminated bodies or in double body bags. Body fluids removed during the embalming process do not pose any additional risks and should be contained and handled according to established procedures.

Standard burials are acceptable when contamination levels are low enough to allow bodies to be handled without wearing additional protective equipment.

C05-A AGENTS

C05-A001

Phosgene Oxime (Agent CX)

CAS: 1794-86-1

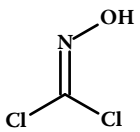
RTECS: —

UN: —

EC: —

UNII: G45S3149SQ

ICD-11: —



C H Cl_2 N O

Colorless to yellow-brown liquid or crystalline deliquescent solid that has an intense, penetrating, disagreeable, and violently irritating odor that is detectable at ≥0.02 ppm. CX is the most irritating of the agents in this class.

Exposure Hazards

Conversion Factor: 1 ppm = 4.66 mg/m^3 at 77°F

$LCt_{50\ (Inh)}$: 3,200 mg-min/m^3 (340 ppm for a 2-minute exposure)

LD_{50}: 1.8 g (estimate)

$ICt_{50\ (Inh)}$: 3 mg-min/m^3 (0.3 ppm for a 2-minute exposure)

These are provisional updates from older values that have not been formally adopted.

$MEG_{(1hr)}$: Neg: 0.0060 ppm; Mar: 0.018 ppm; Crit: 2.8 ppm; Cat: —

PAC-1: 0.0060 ppm; *PAC-2:* 0.018 ppm; *PAC-3:* 2.8 ppm

Interim AEGLs

AEGL-1: 1 hr – 0.006 ppm; 4 hr – 0.0015 ppm; 8 hr – 0.00075 ppm

AEGL-2: 1 hr – 0.018 ppm; 4 hr – 0.0045 ppm; 8 hr – 0.00021 ppm

AEGL-3: 1 hr – 2.8 ppm; 4 hr – 0.67 ppm; 8 hr – 0.34 ppm

Properties:

MW: 113.9	*VP:* 11.2 mmHg (77°F)	*FlP:* 150°F
D: 1.7 g/cm^3	*VD:* 3.9	*LEL:* —
MP: 95°F	*Vlt:* 390 ppm	*UEL*: —
BP: 262°F (Sublimes)	*ER:* —	*RP:* 0.8
Vsc: —	*H_2O:* 70%	*IP:* <11 eV
	Sol: Most organic solvents	

C05-A002

Dibromoformoxime

CAS: 74213-24-4

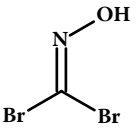
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



C H Br_2 N O

Light yellow solid. No other specific information on physical appearance is available for this agent. Used in chemical synthesis.

Exposure Hazards

Conversion Factor: 1 ppm = 8.30 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published. However, this material is a much less powerful irritant than phosgene oxime (C05-A001).

Properties:

MW: 202.8	*VP:* 24 mmHg (est.)	*FlP:* 87°F (est.)
D: 2.1 g/cm^3 (est.)	*VD:* 7.0	*LEL:* —
MP: 158°F	*Vlt:* —	*UEL*: —

BP: 167°F (3 mmHg)	*ER:* —	*RP:* —
Vsc: —	H_2O: 4% (est.)	*IP:* —
	Sol: —	

C05-A003

Diiodoformoxime

CAS: 201205-56-3

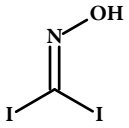
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



C H I_2 N O

Specific information on physical appearance is not available for this agent.

Exposure Hazards

Conversion Factor: 1 ppm = 12.14 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published. However, this material is a much less powerful irritant than phosgene oxime (C05-A001).

Properties:

MW: 296.8	*VP:* —	*FlP:* —
D: —	*VD:* 10	*LEL:* —
MP: 156°F	*Vlt:* —	*UEL:* —
BP: —	*ER:* —	*RP:* —
Vsc: —	H_2O: —	*IP:* —
	Sol: —	

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Toxic Agents



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6 Bicyclophosphate Convulsants

GENERAL INFORMATION

The agents in this class are bicyclophosphates and bicyclothiophosphates. This class of agents is not specifically listed in the Chemical Weapons Convention, nor is it covered by the language of the general definitions in the Schedules. Some of these chemicals have been used as fire retardants, oil lubricants, and for medicinal research. They also occur as breakdown products in some synthetic turbine engine lubricants and some rigid polyurethane foams.

These materials have been evaluated as chemical warfare agents by various countries. They are relatively easy to synthesize. No information is available on dispersing these agents. However, because they produce negligible vapor, they will be somewhat difficult to deliver in a manner that will produce immediate casualties.

Minimal information about these agents or potential research programs concerning these agents has been published in the unclassified literature. There is no information to indicate that these agents were ever stockpiled or have ever been used on the battlefield.

TOXICOLOGY

Effects

These agents are potent cage convulsants that antagonize the gamma-aminobutyric acid (GABA) inhibitory system through blockage of the chloride channel. They induce brief, muscular shock-like jerks (myoclonic seizures) that progress to generalized tonic-clonic (grand mal) convulsions and death. Sub-convulsive doses may cause long-lasting central nervous system sensitization such as an increased susceptibility to sound-induced (audiogenic) seizures and may lead to long-lasting changes in some social behaviors by causing regional decreases in neural substances such as serotonin, dopamine and norepinephrine.

Pathways and Routes of Exposure

Bicyclophosphates are hazardous through any route of exposure including inhalation, skin exposure, ingestion, and broken, abraded, or lacerated skin (e.g., penetration of skin by debris).

General Exposure Hazards

Based on their chemical and physical properties, bicyclophosphates are not expected to have good warning properties. They are unlikely to have any significant odor or to cause significant irritation of the eyes or skin.

Human toxicity data for bicyclophosphates has not been published or has not been established. However, available information indicates that under optimum conditions some of the agents are as toxic as nerve agent VX (C01-A017). Based on animal studies, bicyclophosphates are not cumulative and are rapidly eliminated from the body.

DOI: 10.4324/9781003230571-9

Latency Period

Information on the latency of this class of agents is unavailable. However, based on animal studies, there does not appear to be a significant latent period for convulsive effects. However, effects from sub-convulsive doses may not be immediately obvious.

CHARACTERISTICS

Physical Appearance/Odor

Laboratory Grade

Laboratory grade agents are typically colorless crystalline solids. Odors have not been reported.

Modified Agents

Bicyclophosphates can be dissolved in organic solvents to facilitate handling, stabilize the agents or to increase the ease of percutaneous penetration by the agents. Percutaneous enhancement solvents include dimethyl sulfoxide, N,N-dimethylformamide, N,N-dimethylpalmitamide, N,N-dimethyldecanamide, and saponin. Color and other properties of these solutions may vary from the pure agent. Odors will vary depending on the characteristics of the solvent(s) used.

Stability

Information on the stability of bicyclophosphates has not been published. However, based on the use of similar compounds as flame retardants and lubricant additives, these agents should be highly stable.

Persistency

Information on the persistency of bicyclophosphates has not been published. However, based on similar compounds these agents are likely to be persistent in the environment.

Environmental Fate

Bicyclophosphates are nonvolatile and do not pose a vapor hazard. Although these agents may be dissolved in volatile solvents, evaporation of the solvent does not increase the evaporation of the agent itself. Porous material, including painted surfaces, may absorb solutions of agents. After the initial surface contamination has been removed, agent that has been absorbed into porous material can migrate back to the surface posing a contact hazard.

With the exception of methylbicyclophosphate (C06-A001), which is water soluble, most bicyclophosphates are only slightly soluble or insoluble in water. Most of these agents are also only slightly soluble or insoluble in common organic solvents including gasoline, alcohols, and oils.

ADDITIONAL HAZARDS

Exposure

Although bicyclophosphates do not inhibit acetylcholinesterase, they exhibit a synergistic toxic effect with materials that do. Individuals who have had previous exposure to cholinesterase inhibitors such as nerve agents and commercial organophosphate or carbamate pesticides may be a greater risk from exposure to bicyclophosphates.

Exposure to doses below the level that will produce seizures can results in long-lasting central nervous system sensitization such as an increased susceptibility to sound-induced (audiogenic) seizures.

All foodstuffs in the area of a release should be considered contaminated. Unopened items packaged in glass, metal or high-density plastics and exposed only to agent aerosols may be used after decontamination of the container. Unopened items exposed to solid agents or solutions of agents should be decontaminated within a few hours post exposure or destroyed. Opened or unpackaged items, or those packaged only in paper or cardboard, should be destroyed.

Meat, milk and animal products from animals exposed to or killed by bicyclophosphates should be destroyed or quarantined until they are tested and determined to be safe to consume.

Plants, fruits, vegetables, and grains should be quarantined until tested and determined to be safe to consume.

Livestock/Pets

Animals can be decontaminated with shampoo or soap and water. If the animal's eyes have been exposed to agent, they should be irrigated with water or saline solution for a minimum of 30 minutes.

The topmost layer of unprotected feedstock (e.g., hay or grain) should be destroyed. The remaining material should be quarantined until tested. Leaves of forage vegetation could still retain sufficient agent to produce effects for several weeks post release, depending on the level of contamination and the weather conditions.

Fire

Some members of this class of agents have been employed as fire retardants and therefore these agents are not expected to be greatly affected by a fire. However, actions taken to extinguish the fire could spread the agent. Runoff from firefighting efforts could pose a significant contact threat. Under the appropriate conditions, these agents could decompose and potentially produce toxic and/or corrosive gases.

Reactivity

Information on the reactivity of bicyclophosphates has not been published.

Hazardous Decomposition Products

Information on the decomposition product of bicyclophosphates, through either hydrolysis or combustion, has not been published.

PROTECTION

Evacuation Recommendations

There are no published recommendations for isolation or protective action distances for bicyclophosphate agents released in mass casualty situations.

Personal Protective Requirements

Structural Firefighters' Gear

Structural firefighters' protective clothing is recommended for fire situations only; it is not effective in spill situations or release events. However, since bicyclophosphates have negligible vapor pressure, they do not pose a vapor hazard. The primary risk of exposure is through contact with aerosolized agents, solids, or solutions of agents. If chemical protective clothing is not available and it is necessary to rescue casualties from a contaminated area, then structural

firefighters' gear will provide some skin protection against agent aerosols. Contact with solids and solutions should be avoided.

Even though it is likely that bicyclophosphates will be rapidly detoxified or eliminated from the body, sub-convulsive insidious exposures may cause long lasting central nervous system sensitization, placing all responders who entered the hot zone without appropriate chemical protective clothing are at increased risk.

Respiratory Protection

Self-contained breathing apparatuses (SCBAs) or air purifying respirators (APRs) should have a National Institute for Occupational Safety and Health (NIOSH) Chemical/Biological/Radiological/Nuclear (CBRN) certification. However, during emergency operations, other NIOSH-approved SCBAs or APRs that have been specifically tested by the manufacturer against chemical warfare agents may be used if deemed necessary by the incident commander. APRs should be equipped with a NIOSH-approved CBRN filter or a combination organic vapor/acid gas/particulate cartridge.

Immediately dangerous to life or health (IDLH) levels are the ceiling limit for respirators other than SCBAs. However, IDLH levels have not been established for bicyclophosphates. Therefore, any potential exposure to these agents should be regarded with extreme caution and the use of SCBAs for respiratory protection should be considered.

Chemical Protective Clothing

Currently, there is no information on performance testing of chemical protective clothing against bicyclophosphates.

Because these agents do not produce any significant concentration of vapor, the primary risk of exposure is through inhalation of aerosols or by the percutaneous migration of agent following dermal exposure to solid agents or solutions containing these agents. However, it is possible that aerosolized bicyclophosphates can also enter the body and produce a toxic effect by permeating through the skin or penetrating through broken, abraded, or lacerated skin. If there is any possibility of contact with aerosolized agent, then responders should consider wearing a Level A protective ensemble.

Decontamination

General

Specific information on decontaminating bicyclophosphates has not been published. Apply universal decontamination procedures using soap and water.

Solutions or Liquid Aerosols

Casualties/personnel

Cover all open wounds during the decontamination process. Remove all clothing immediately. To avoid further exposure of the head, neck and face to the agent, cut off potentially contaminated clothing that must be pulled over the head. Remove as much of the agent from the skin as fast as possible. If water is not immediately available, the agent can be absorbed with any convenient material such as paper towels, toilet paper, flour, or talc. To minimize both spreading the agent and abrading the skin, do not rub the agent with the absorbent. Blot the contaminated skin with the absorbent.

Use a sponge or cloth with liquid soap and copious amounts of water to wash the skin surface and hair at least three times. Ideally, showers will be high volume with low pressure. Do not delay decontamination to find warm or hot water if it is not readily available. Avoid rough scrubbing as this could abrade the skin and increase percutaneous absorption of residual agent. Rinse with copious amounts of water. If there is a potential that the eyes have been exposed to bicyclophosphates, irrigate with water or 0.9% saline solution for a minimum of 15 minutes.

Small areas

Ventilate to remove the aerosol. Puddles of liquid can be contained by covering with absorbent material such as vermiculite, diatomaceous earth, clay, sponges, or towels. Place the absorbed material into containers lined with high-density polyethylene. Wash the area and the exterior of the container with copious amounts of the soap and water. Collect and containerize the rinseate.

Solids or Particulate Aerosols

Casualties/personnel

Cover all open wounds during the decontamination process. Do not attempt to brush the agent off of the individual or their clothing as this can aerosolized the agent. If possible, dampen the agent with a water mist to help prevent aerosolization. Remove all clothing immediately. To avoid further exposure of the head, neck, and face to the agent, cut off potentially contaminated clothing that must be pulled over the head. Wash the skin surface and hair at least three times with copious amounts of soap and water. Ideally, showers will be high volume with low pressure. Do not delay decontamination to find warm or hot water if it is not readily available. Rinse with copious amounts of water. If there is a potential that the eyes have been exposed to bicyclophosphates, irrigate with water or 0.9% saline solution for a minimum of 15 minutes.

Small areas

If indoors, close windows and doors in the area and turn off anything that could create air currents (e.g., fans, air conditioner, etc.). Allow aerosol to settle. Avoid actions that could aerosolize the agent such as sweeping or brushing. Collected the agent with a vacuum cleaner equipped with a high-efficiency particulate air (HEPA) filter. Do not use a standard home or industrial vacuum. Do not allow the vacuum exhaust to stir the air in the affected area. Vacuum all surfaces with extreme care in a very slow and controlled manner to minimize aerosolizing the agent. Place the collected material into containers lined with high-density polyethylene. Wash the area and the exterior of the container with copious amounts of the soap and water. Collect and containerize the rinseate.

MEDICAL

CDC Case Definition

The CDC has not published a specific case definition for intoxication by bicyclophosphates.

Differential Diagnosis

The following factors have been suggested as alternatives to consider when presented with a potential case of exposure to bicyclophosphates: history of epilepsy; exposure to alcohol, cocaine, lead, camphor, strychnine, or carbon monoxide; medicinals such as phenothiazines; head trauma, heatstroke; encephalitis, meningitis, and tetanus.

Signs and Symptoms

Sudden loss of consciousness followed by tonic, then clonic contractions of the muscles. In some cases, the gastrointestinal tract may be affected producing urination, defecation, or both.

Mass-Casualty Triage Recommendations

There are no recommendations for triaging casualties exposed to bicyclophosphates. However, in general, anyone who has been exposed should be transported to a medical facility for evaluation.

Individuals who are asymptomatic and have not been directly exposed to the agent can be discharged after their names, addresses, and telephone numbers have been recorded. They should be told to seek medical care immediately if symptoms develop.

Casualty Management

Decontaminate the casualty ensuring that all bicyclophosphates has been removed. If any bicyclophosphates have gotten into the eyes, irrigate the eyes with water or 0.9% saline solution for at least 15 minutes. Irrigate open wounds with water or 0.9% saline solution for at least 10 minutes.

Once the casualty has been decontaminated, including the removal of foreign matter from wounds, medical personnel do not need to wear a chemical-protective mask.

Ventilate the patient. If breathing is difficult, administer oxygen. It may be appropriate to intubate the casualty since seizures may make it difficult or impossible later. Otherwise, treatment consists of symptomatic management of seizures. Do not attempt to immobilize or protect the tongue. Loosen clothing around the neck and place a pillow under the head to prevent injury. Roll the casualty onto their side to prevent aspiration of fluids. Avoid unnecessary disturbances including loud or sudden noises. Treatment with anticonvulsants, including diazepam, phenobarbital, and other traditional antiepileptic drugs, have been successful in some animal studies.

FATALITY MANAGEMENT

Remove all clothing and personal effects segregating them as either durable or non-durable items. While it may be possible to decontaminate durable items, it may be safer and more efficient to destroy non-durable items rather than attempt to decontaminate them. Items that will be retained for further processing should be double sealed in impermeable containers, ensuring that the inner container is decontaminated before placing it in the outer one.

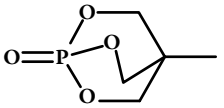
Bicyclophosphates that have entered the body pose little threat of off-gassing. To remove agents on the outside of the body, wear appropriate respiratory and dermal protective clothing while washing the remains with soap and water. Pay particular attention to areas where agent may get trapped, such as hair, scalp, pubic areas, fingernails, folds of skin, and wounds. All wash and rinse waste must be contained for proper disposal. Body fluids removed during the embalming process do not pose any additional risks and should be contained and handled according to established procedures.

Cadavers pose no significant secondary hazards after decontamination. Use standard burial practices.

C06-A AGENTS

C06-A001

Methylbicyclophosphate
CAS: 1449-89-4
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_4\ H_9\ O_4\ P$

Crystalline solid.

Exposure Hazards

Conversion Factor: 1 ppm = 6.22 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be approximately 0.1% as toxic as VX (C01-A017).

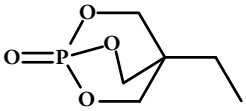
Properties:

MW: 152.1	*VP:* 0.656 mmHg 77°F (est.)	*FlP:* —
D: 1.37 g/cm^3	*VD:* 5.2	*LEL:* —
MP: 150°F (est.)	*Vlt:* —	*UEL:* —
BP: 380°F (est.)	*ER:* —	*RP:* —
Vsc: —	*H_2O:* Soluble	*IP:* —
	Sol: —	

C06-A002

Ethylbicyclophosphate

CAS: 1005-93-2
RTECS: TY6475000
UN: —
EC: 213-740-6
UNII: —
ICD-11: —



$C_6\ H_{11}\ O_4\ P$

White crystalline solid.

Exposure Hazards

Conversion Factor: 1 ppm = 7.29 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

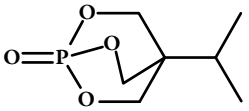
Properties:

MW: 178.1	*VP:* 0.2 mmHg (est.)	*FlP:* —
D: 1.3 g/cm^3 (est.)	*VD:* 6.1	*LEL:* —
MP: —	*Vlt:* —	*UEL:* —
BP: 440°F (est.)	*ER:* —	*RP:* —
Vsc: —	*H_2O:* Soluble	*IP:* —
	Sol: —	

C06-A003

Isopropylbicyclophosphate

CAS: 51052-72-3
RTECS: TY682500
UN: —
EC: —
UNII: —
ICD-11: —



$C_7\ H_{13}\ O_4\ P$

Specific information on physical appearance is not available for this agent.

Exposure Hazards

Conversion Factor: 1 ppm = 7.86 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be less than half as toxic as VX (C01-A017).

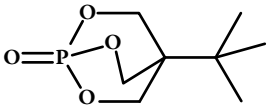
Properties:

MW: 192.2	*VP:* —	*FlP:* —
D: 1.2 g/cm^3 (est.)	*VD:* 6.6	*LEL:* —
MP: —	*Vlt:* —	*UEL:* —
BP: 460°F (est.)	*ER:* —	*RP:* —
Vsc: —	*H_2O:* 6% (est.)	*IP:* —
	Sol: —	

C06-A004

t-Butylbicyclophosphate

CAS: 61481-19-4
RTECS: TY3700000
UN: —
EC: —
UNII: —
ICD-11: —



$C_8\ H_{15}\ O_4\ P$

Specific information on physical appearance is not available for this agent.

Exposure Hazards

Conversion Factor: 1 ppm = 8.43 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be just as toxic as VX (C01-A017).

Properties:

MW: 206.2	*VP:* 0.0075 mmHg (est.)	*FlP:* —
D: 1.2 g/cm^3 (est.)	*VD:* 7.1	*LEL:* —
MP: —	*Vlt:* —	*UEL:* —
BP: 460°F (est.)	*ER:* —	*RP:* —
Vsc: —	*H_2O:* Slight	*IP:* —
	Sol: —	

C06-A005

1-Thio-4-ethyl-2,6,7-trioxa-1-phosphabicyclo-[2.2.2]-octane

CAS: 935-52-4

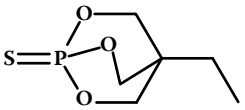
RTECS: —

UN: —

EC: —

UNII: —

ICD-11: —



C_6 H_{11} O_3 P S

White solid.

Exposure Hazards

Conversion Factor: 1 ppm = 7.94 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

MW: 194.2	*VP:* 0.9 mmHg (est.)	*FlP:* —
D: 1.3 g/cm^3 (est.)	*VD:* 6.7	*LEL:* —
MP: 354°F	*Vlt:* —	*UEL:* —
BP: 460°F (est.)	*ER:* —	*RP:* —
Vsc: —	*H_2O:* Slight	*IP:* —
	Sol: Ethanol	

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7 COX-Inhibiting Blood Agents

GENERAL INFORMATION

These agents inhibit the enzyme cytochrome oxidase (COX), preventing the transfer of oxygen from the blood to the cells. Materials include cyanides, halogenated cyanides and hydrogen sulfide (C07-A006). They were used during World War I and were the first systemic agents introduced into war. They are well-known industrial materials that were readily available at that time; most still have commercial value. Hydrogen cyanide (C07-A001) and cyanogen chloride (C07-A003) are listed in Schedule 3 of the Chemical Weapons Convention and are the only COX-inhibiting blood agents specifically included in the convention. COX-inhibiting blood agents are relatively easy to acquire or manufacture and to disperse. For information on some of the chemicals used to manufacture these blood agents, see the component section (C07-C) following information on the individual agents.

Blood agents have been stockpiled by most countries that have pursued a chemical weapons program, and have been used a number of times on the battlefield. Although this class of agents is generally considered to be obsolete on the modern battlefield, several of these agents are still considered a significant threat as potential improvised weapons that could be utilized in urban warfare. COX-inhibiting blood agents have been used for assassinations and also by terrorists.

TOXICOLOGY

Effects

COX-inhibiting blood agents are compounds that produce respiratory paralysis and seizures or stop the transfer of oxygen from blood to the rest of the body by inhibiting the enzyme cytochrome oxidase. The lack of oxygen rapidly affects all body tissues, especially the central nervous system, producing headache, dizziness, confusion, stupor, nausea, and vomiting. The cyanogen halide agents will also cause lung membranes to swell and become filled with liquid (pulmonary edema).

Pathways and Routes of Exposure

COX-inhibiting blood agents are primarily an inhalation hazard. However, liquid agents, or solutions containing these agents, are hazardous through skin and eye exposure, ingestion, and abraded skin (e.g., breaks in the skin or penetration of skin by debris). At high concentrations, agent vapor may pose a skin absorption hazard.

General Exposure Hazards

COX-inhibiting blood agents generally do not have good warning properties. Although many cyanides have distinct odors that are evident at low levels, there is a significant portion of the population that is genetically incapable of detecting them. Hydrogen sulfide (C07-A006) rapidly causes olfactory fatigue preventing further detection of the agent. Cyanogen halides cause eye irritation and tearing (lacrimation) at low concentrations.

Lethal concentrations (LC_{50}s) for inhalation of these agents are as low as 1,300 parts per million for a 2-minute exposure.

Lethal percutaneous exposures (LD_{50}s) to liquified agents are as low as 7 grams per individual.

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The body detoxifies these agents relatively quickly and, other than complications resulting from damage to lung membranes, recovery from nonfatal acute effects is generally rapid.

Latency Period

Vapor

Effects from vapor exposure begin to appear 1to 2minutes after exposure. Signs and symptoms of lung damage (e.g., pulmonary edema), caused by inhalation of cyanogen halides, do not appear until after a substantial latency period.

Liquid

Effects from exposure to liquid agents may be delayed from several minutes up to 2 hours after exposure. Some factors affecting the length of time before the onset of symptoms are the amount of agent involved, the amount of skin surface in contact with the agent, previous exposure to materials that chap or dry the skin (e.g., organic solvents such gasoline or alcohols), and addition of additives designed to enhance the rate of percutaneous penetration by the agents.

Another key factor is the part of the body that is exposed to the agent. It takes the agent longer to penetrate areas of the body that are covered by thicker and tougher skin. The regions of the body that allows the fastest percutaneous penetration are the groin, head and neck. The least susceptible body regions are the hands, feet, front of the knee and outside of the elbow.

CHARACTERISTICS

Physical Appearance/Odor

Laboratory Grade

COX-inhibiting blood agents are either gases or volatile liquids. Most agents are colorless, but detectable odors vary from mildly pleasant to harsh and irritating. The ability to detect the odor of some agents is transient and may give the impression that agents are no longer present. Some agents, especially in high concentration, may cause eye irritation and tearing.

Munition Grade

Munition grade agents are typically colorless but can be yellow to brown and may contain crystallized decomposition products. Odors, if present, vary from mildly pleasant to harsh and irritating.

Binary/Reactive Agents

Terrorists have used binary versions created by mixing acids with reactive materials such as cyanide salts. Since the agent is formed as a result of mixing, it will be crude and consist of the agent, the individual components, and any byproducts formed during the reaction. The color, odor and consistency of the resulting agent will vary depending on the quality of the components and the degree of mixing.

The components, by-products of the reaction, or solvents used to facilitate mixing the components may have their own toxic properties and could present additional hazards. Residual components may react with common materials, such as metals, to produce other hazardous materials.

Modified Agents

Solvents, such as carbon disulfide (CS_2) and chloroform ($CHCl_3$), have been added to COX-inhibiting blood agents to increase their stability in storage and increase their persistency after their

release. The color, odor and consistency of these mixtures will vary depending on the characteristics of the solvent(s) used and concentration of agent in the solution.

COX-inhibiting blood agents have also been adsorbed onto a solid carrier, such as pumice, to facilitate dispersal of the agent and increase their persistency after their release. These compositions may appear as free-flowing powders or as a coarse grit. Odors may vary from the unmodified agent.

Mixtures with Other Agents

COX-inhibiting blood agents have been mixed with other agents such as bromoacetone (C13-A003, Volume 2), chloropicrin (C10-A006), arsenic trichloride (C04-C006) and stannic chloride ($SnCl_4$) to increase their stability in storage, enhance their toxicity, or to act as a marker during deployment.

Stability

Cyanide blood agents are relatively unstable and tend to polymerize on standing. Polymers can be explosive. Stabilizers or solvents can be added to inhibit decomposition. Stabilizers include phosphoric acid, sulfuric acid, powdered sodium pyrophosphate and sulfur dioxide. Although cyanide blood agents react with metals, they can be stored in steel or other common containers if stabilized.

Hydrogen sulfide (C07-A006) is stable and stored as a compressed, liquified gas in aluminum or stainless-steel cylinders.

Persistency

For military purposes, unmodified COX-inhibiting blood agents are classified as non-persistent. These agents are gases or highly volatile liquids at normal temperatures. Evaporation rates of liquid agents are more than 10 times that of water. Cold weather may decrease the rate of evaporation of liquid or solid agents.

Environmental Fate

Other than hydrogen cyanide (C07-A001), agent vapors have a density greater than air and tend to collect in low places. However, due to the volatile nature of these materials, there is minimal extended risk except in an enclosed or confined space.

With the exception of hydrogen cyanide (C07-A001), which is miscible with water, most of these agents are only slightly soluble or insoluble in water. However, agent solubility may be modified (either increased or decreased) by solvents or impurities. These agents are soluble in many organic solvents including gasoline, alcohols and oils.

ADDITIONAL HAZARDS

Exposure

All foodstuffs in the area of a release should be considered contaminated. Unopened items packaged in glass, metal or heavy-duty plastic and exposed only to agent vapors may be used after decontamination of the container. Unopened items exposed to liquid agents or solutions of agents should be decontaminated within a few hours post-exposure or destroyed. Opened or unpackaged items, or those packaged only in paper or cardboard, should be destroyed.

Meat from animals that have survived exposure to COX-inhibiting blood agents should be safe to consume after a short quarantine period. Milk should be quarantined until tested.

Plants, fruits, vegetables and grains should be quarantined until tested and determined to be safe to consume. Aeration or decontamination with soap and water may be sufficient in many cases.

Livestock/Pets

Animals can be decontaminated with shampoo/soap and water. If the animal's eyes have been exposed to the agent, they should be irrigated with water or saline solution for a minimum of 30 minutes.

The topmost layer of unprotected feedstock (e.g., hay or grain) should be destroyed. The remaining material should be quarantined until tested. Leaves of forage vegetation are unlikely to retain sufficient agent to produce significant effects for more than a few hours post-release.

Fire

Some COX-inhibiting blood agents are flammable and can form explosive mixtures with air. Some of these agents can polymerize in their containers and explode when heated.

Most of these blood agents are gases and will dissipate quickly or be consumed in a fire. If liquid or solid agents are present, then heat from a fire will increase the amount of agent vapor in the area. A significant amount of the agent could be volatilized and escape into the surrounding environment before it is consumed by the fire. Actions taken to extinguish the fire can also spread the agent. With the exception of hydrogen cyanide (C07-A001), most COX-inhibiting blood agents are only slightly soluble or insoluble in water. However, runoff from firefighting efforts may still pose a threat. Some of the decomposition products resulting from hydrolysis or combustion of COX-inhibiting blood agents are water soluble and highly toxic. Other potential decomposition products include toxic and/or corrosive gases. Solvents mixed with some agents are flammable and may pose an additional fire hazard. Added components may react with steam or water during a fire to produce toxic, flammable and/or corrosive gases.

Reactivity

With the exception of hydrogen sulfide (C07-A006), COX-inhibiting blood agents must be stabilized or they will polymerize during storage. Some agents are slowly hydrolyzed by water to produce corrosive and toxic gases. They are incompatible with strong oxidizers; many are incompatible with strong corrosives. Added components may react with water to produce toxic, flammable and/or corrosive vapors.

Hazardous Decomposition Products

Hydrolysis

Hydrogen cyanide (C07-A001) is highly soluble and stable in water. Many other agents in this class decompose into hydrogen cyanide and/or corrosive chemicals such as hydrogen chloride (HCl), hydrogen bromide (HBr), hydrogen fluoride (HF) or hydrogen iodide (HI). Some added components may produce arsenous oxides or arsenic salts when hydrolyzed.

Combustion

Volatile decomposition products may include nitrogen oxides (NO_x), sulfur oxides (SO_x) as well as hydrogen chloride (HCl), hydrogen bromide (HBr), hydrogen fluoride (HF) or hydrogen iodide (HI). Some added components may produce arsenic oxides.

PROTECTION

Evacuation Recommendations

Isolation and protective action distances listed below are taken from the 2020 Emergency Response Guidebook. For COX-inhibiting blood agents, these recommendations are based on two different release mechanisms (i.e., direct aerosolization of liquid agents or sabotage of commercial containers) as well as on various quantities of material depending on the agent used in the release.

For AC, the release scenario involves sabotage of a commercial container with either 200 kilograms (approximately 290 liters) of liquified agent or 30,000 kilograms (approximately 43,000 liters) of liquified agent.

For CK, the release involves direct aerosolization of the liquid agents with a particle size between 2 and 10 microns. A small release involves 30 kilograms (approximately 25 liters) of liquified agent and a large release involves 500 kilograms (approximately 420 liters) of liquified agent.

AC (Hydrogen Cyanide) *C07-A001*

	Initial Isolation	Downwind Day	Downwind Night
Small device (200 kg)	60 m	0.3 km	1.0 km
Large device (30,000 kg)	1,000 m	3.7 km	8.4 km

CK (Cyanogen Chloride) *C07-A003*

	Initial Isolation	Downwind Day	Downwind Night
Small device (30 kg)	30 m	0.2 km	1.4 km
Large device (500 kg)	300 m	1.4 km	6.1 km

Personal Protective Requirements

Structural Firefighters' Gear

COX-inhibiting blood agents are primarily a respiratory hazard; however, solids, liquids or high vapor concentrations may pose a percutaneous hazard. Structural firefighters' protective clothing is recommended for fire situations only; it is not effective in spill situations or release events. If chemical protective clothing is not available and it is necessary to rescue casualties from a contaminated area, then structural firefighters' gear will provide limited skin protection against low concentrations of these vapors. Contact with liquids, solids and solutions should be avoided.

Respiratory Protection

Self-contained breathing apparatuses (SCBAs) or air purifying respirators (APRs) should have a National Institute for Occupational Safety and Health (NIOSH) Chemical/Biological/Radiological/Nuclear (CBRN) certification. However, during emergency operations, other NIOSH-approved SCBAs or APRs that have been specifically tested by the manufacturer against chemical warfare agents may be used if deemed necessary by the incident commander. APRs should be equipped with a NIOSH-approved CBRN filter or a combination organic vapor/acid gas/particulate cartridge.

High concentrations of cyanides and cyanogen halides can rapidly degrade elements of some air purification filters. Care should be taken whenever using APRs in the presence of these agents.

Immediately dangerous to life or health (IDLH) levels are the ceiling limit for respirators other than SCBAs. Any exposures approaching the IDLH level should be regarded with extreme caution and the use of SCBAs for respiratory protection should be considered.

Chemical Protective Clothing

Use only chemical protective clothing that has undergone material and construction performance testing against cyanides, cyanogen halides and hydrogen sulfide (C07-A006). Reported permeation rates may be affected by solvents, components or impurities in munition grade or modified agents.

In addition to the risk of percutaneous migration of the agent following dermal exposure to liquid agents, some cyanide agent vapors can also penetrate the skin and produce a toxic effect. However, these concentrations are significantly greater than concentrations that will produce similar effects if inhaled. If the concentration of vapor exceeds the level necessary to produce effects through dermal exposure, then responders should wear a Level A protective ensemble.

Decontamination

General

Apply universal decontamination procedures using soap and water.

Vapors

Casualties/personnel

Remove all clothing as it may continue to emit trapped agent vapor after contact with the vapor cloud has ceased. Shower using copious amounts of soap and water. Ideally, showers will be high volume with low pressure. Ensure that the hair has been washed and rinsed to remove potentially trapped vapor. If eye irritation occurs, irrigate with water or 0.9% saline solution for a minimum of 15 minutes.

Small areas

Ventilate to remove the vapors. Because the boiling point of some cyanide agents is near normal room temperature (70°F), agent vapors may condense on cooler surfaces and pose a percutaneous hazard. Liquids can then re-volatilize when the temperature rises. If deemed necessary, wash the area with copious amounts of soap and water. Collect the rinseate and place into containers lined with high-density polyethylene.

Liquids, Solutions or Liquid Aerosols

Casualties/personnel

Cover all open wounds during the decontamination process. Remove all clothing immediately. Even clothing that has not come into direct contact with the agent may contain trapped vapor. To avoid further exposure of the head, neck and face to the agent, cut off potentially contaminated clothing that must be pulled over the head. Use a sponge or cloth with liquid soap and copious amounts of water to wash the skin surface and hair at least three times. Ideally, showers will be high volume with low pressure. Avoid rough scrubbing. Rinse with copious amounts of water. If water is not immediately available, the agent can be absorbed with any convenient material such as paper towels, toilet paper, flour or talc. To minimize both spreading the agent and abrading the skin, do not rub the agent with the absorbent. Blot the contaminated skin with the absorbent. If

there is a potential that the eyes have been exposed, irrigate with water or 0.9% saline solution for a minimum of 15 minutes.

Small areas

Ventilate to remove the aerosol. Puddles of liquid can be contained by covering with absorbent material such as vermiculite, diatomaceous earth, clay, sponges or towels. Place the absorbed material into containers lined with high-density polyethylene. Wash the area with copious amounts of the soap and water. Collect and containerize the rinseate. Ventilate the area to remove residual vapors.

Solids or Particulate Aerosols

Casualties/personnel

Do not attempt to brush the agent off of the individual or their clothing as this can aerosolized the agent. Cover all open wounds during the decontamination process. If possible, dampen the agent with a water mist to help prevent aerosolization. Remove all clothing immediately. To avoid further exposure of the head, neck and face to the agent, cut off potentially contaminated clothing that must be pulled over the head. Wash the skin surface and hair at least three times with copious amounts of soap and water. Ideally, showers will be high volume with low pressure. Do not delay decontamination to find warm or hot water if it is not readily available. Rinse with copious amounts of water. If there is a potential that any of the agent has gotten into the eyes, irrigate with water or 0.9% saline solution for a minimum of 15 minutes.

Small areas

If indoors, close windows and doors in the area and turn off anything that could create air currents (e.g., fans, air conditioner, etc.). Allow the aerosol to settle. Avoid actions that could aerosolize the agent such as sweeping or brushing. Collect the agent using a vacuum cleaner equipped with a high-efficiency particulate air (HEPA) filter. Do not use a standard home or industrial vacuum. Do not allow the vacuum exhaust to stir the air in the affected area. Vacuum all surfaces with extreme care in a very slow and controlled manner to minimize aerosolizing the agent. Place the collected material into containers lined with high-density polyethylene. Wash the area with copious amounts of the soap and water. Collect and containerize the rinseate in containers lined with high-density polyethylene. Ventilate the area to remove any agent vapors generated during the decontamination.

MEDICAL

CDC Case Definition

For cyanides: 1) A case in which cyanide concentration in whole blood is elevated. OR 2) Cyanide is detected in environmental samples. The case can be confirmed if laboratory testing is not performed because either a predominant amount of clinical and nonspecific laboratory evidence is present or an absolute certainty of the etiology of the agent is known.

The CDC has not published a specific case definition for intoxication by hydrogen sulfide (C07-A006).

Differential Diagnosis

The following factors have been suggested as alternatives to consider when presented with a potential case of exposure to COX-inhibiting blood agents: smoke or carbon monoxide inhalation; sedatives; stroke; methemoglobinemia; meningitis and encephalitis; ingestion of plants or seeds containing cyanoglycosides.

Signs and Symptoms

Vapors/Aerosols

Most indications of cyanide and sulfide blood agent poisoning are non-specific. Inhalation of a high concentration of these agents may produce temporary rapid and deep breathing followed by convulsions and unconsciousness. Under these circumstances, the casualty will stop breathing within 2 to 4minutes after exposure. Death will occur 4to 8minutes later. For most cyanides, casualties experience few effects when exposed to less than lethal doses. These may include a temporary increase in breathing rate with dizziness, nausea, vomiting and headache. Classic cherry-red skin and lips attributed to cyanide poisoning are not always present. In addition, cyanogen halides produce immediate eye, nose and throat irritation similar to tear agents (C13, Volume 2) and vomiting agents (C14, Volume 2). Accumulation of fluid in the lungs (pulmonary edema) caused by cyanogen halides may be delayed for several hours.

Liquids/Solids

Exposure to solid or liquid cyanogen halides can cause skin and eye irritation. Otherwise, casualties exposed to cyanides experience few effects at sublethal doses. Percutaneous absorption of a lethal dose may produce temporary rapid and deep breathing followed by convulsions and unconsciousness. Under these circumstances, the casualty will stop breathing within 2 to 4 minutes after exposure. Death will occur 4 to 8 minutes later.

Mass-Casualty Triage Recommendations

Priority 1

A casualty who is convulsing or is post-seizure, who has a heartbeat and a palpable blood pressure. The casualty may or may not be conscious and/or breathing.

Priority 2

Recovering from mild effects or from successful therapy. Generally, it takes hours for full recovery.

Priority 3

Casualty who has been in a clean environment for more than 5 minutes post-exposure and is conscious and talking; OR a casualty in a clean environment who is unconscious but has a pulse and is breathing normally. Unconscious casualties should be monitored in case of a sudden change in status.

Priority 4

A casualty who is not breathing and does not have a heartbeat or palpable blood pressure.

Casualty Management

Remove casualty to fresh air. If breathing is difficult, administer oxygen. If the casualty has been exposed to either solid or liquid agent, decontaminate the casualty ensuring that all agent has been removed. However, do not delay treatment if thorough decontamination cannot be undertaken immediately. If solid or liquid agents have gotten into the eyes or if the casualty complains of significant eye irritation, irrigate the eyes with water or 0.9% saline solution for at least 15 minutes. Irrigate open wounds with water or 0.9% saline solution for at least 10 minutes. Once the casualty has been decontaminated, including the removal of foreign matter from wounds, medical personnel do not need to wear a chemical-protective mask.

For cyanide and cyanogens, an antidote should be administered as soon as possible. Various antidote kits are available that remove cyanide from the blood. Some contain drugs (e.g., amyl nitrite, sodium nitrite, sodium thiosulfate) that generate methemoglobin and encourage excretion from the body, while others contain chelating agents (e.g., hydroxocobalamin, cobalt edentate) that complex directly with the cyanide. Some studies also support the use of nitrites for treatment of hydrogen sulfide (C07-A006) intoxication and they have been used as an antidote in emergency situations. Benzodiazepines or barbiturates may be required to control severe seizures.

Combined intoxications of cyanide or cyanogens with carbon monoxide (C09-A001) should not be treated with the antidote kits containing nitrites. The resulting methemoglobinemia will exacerbate carbon monoxide poisoning by further reducing the ability of the blood to deliver oxygen to body tissue.

If cyanogen halides are suspected, asymptomatic individuals should be monitored for possible complications caused by accumulation of fluid in the lungs (pulmonary edema).

FATALITY MANAGEMENT

Remove all clothing and personal effects. Heavily splashed items should be disposed of or decontaminate with soap and water. Items that will be retained for further processing should be double sealed in impermeable containers, ensuring that the inner container is decontaminated before placing it in the outer one.

COX-inhibiting blood agents are highly volatile and there is little risk of extensive residual contamination unless the remains were heavily splashed with liquid agent. Agents that have entered the body pose little threat through off-gasing. Some agents, such as hydrogen sulfide (C07-A006), may still be detectible because of the low odor threshold. Wash the remains with soap and water. Pay particular attention to areas where agent may get trapped, such as hair, scalp, pubic areas, fingernails, folds of skin and wounds. If remains were heavily splashed with agent, wash and rinse waste should be contained for proper disposal. Screen the remains for agent vapors at the conclusion of the decontamination process. Once the remains have been thoroughly decontaminated, no further protective action is necessary. Body fluids removed during the embalming process do not pose any additional risks and should be contained and handled according to established procedures. Use standard burial procedures.

C07-A AGENTS

C07-A001

Hydrogen Cyanide (Agent AC)
CAS: 74-90-8
RTECS: MW6825000
UN: 1051; 117
EC: 200-821-6
UNII: 2WTB3V159F
ICD-11: XM8WA4

HCN

Colorless gas or liquid with an odor like bitter almond or peach kernels. Odor is detectable at ≥0.8 ppm, but some individuals are unable to detect odor at all. Used as an industrial fumigant. It is also used in electroplating, mining; and in producing synthetic fibers, plastics, and dyes. Industrially, it can be found mixed with a variety of gases including carbon monoxide, cyanogen, and phosphine.

Also reported as a mixture with cyanogen chloride (C07-A003); arsenic trichloride (C04-C006); ethyl iodoacetate (C13-A012).

This material is on Schedule 3 of the CWC, DHS Chemicals of Interest list, FBI list, Australia Chemicals of Security Concern list, and the ITF-25 High Threat list.

Ignites 50% of the time when disseminated from an artillery shell.

Exposure Hazards

Conversion Factor: 1 ppm = 1.10 mg/m^3 at 77°F

$LCt_{50\ (Inh)}$: 2,860 mg-min/m^3 (1,300 ppm for a 2-minute exposure). This is a provisional update from an older value that has not been formally adopted. LCt_{50} varies greatly due to ability of the body to detoxify the agent over time.

LC_{50}: 524 ppm for a 10-minute exposure

$MEG_{(1hr)}$: Neg: 2.0 ppm; Mar: 7.1 ppm; Crit: 15 ppm; Cat: —

PAC-1: 2.0 ppm; *PAC-2:* 7.1 ppm; *PAC-3:* 15 ppm

PEL: 10 ppm [Skin]

$STEL_{(NIOSH)}$: 4.7 ppm [Skin]

$Ceiling_{(ACGIH)}$: 4.7 ppm [Skin]

IDLH: 50 ppm [Skin]

Final AEGLs

AEGL-1: 1 hr – 2.0 ppm; 4 hr – 1.3 ppm; 8 hr – 1.0 ppm

AEGL-2: 1 hr – 7.1 ppm; 4 hr – 3.5 ppm; 8 hr – 2.5 ppm

AEGL-3: 1 hr – 15 ppm; 4 hr – 8.6 ppm; 8 hr – 6.6 ppm

Properties:

MW: 27.0	*VP:* 630 mmHg	*FlP:* 0°F
D: 0.69 g/mL (77°F)	*VD:* 0.99	*LEL:* 5.6%
MP: 8°F	*Vlt:* 860,000 ppm	*UEL*: 40%
BP: 78°F	*ER:* 630	*RP:* 0.03
Vsc: 0.28 cS (77°F)	*H_2O:* Miscible	*IP:* 13.60 eV
	Sol: Most organic solvents	

C07-A002

Cyanogen Bromide (Agent CB)
CAS: 506-68-3
RTECS: GT2100000
UN: 1889; 157
EC: 208-051-2
UNII: OS382OHJ8P
ICD-11: —

BrCN

Colorless or white crystalline solid with a penetrating, stinging or biting odor.

Also reported as a mixture with Bromoacetone (C13-A003).

This material is on the Australia Chemicals of Security Concern list.

Exposure Hazards

Conversion Factor: 1 ppm = 4.33 mg/m^3 at 77°F
$LC_{50\ (Inh)}$: 400 mg/m^3 (92 ppm for a 10-minute exposure)
$IC_{50\ (Inh)}$: 35 mg/m^3 (8.1 ppm); exposure duration unspecified
Eye Irritation: 1.4 ppm; exposure duration unspecified

These values are from older sources (circa 1937) and are not supported by modern data. No updated toxicity estimates have been proposed.

$MEG_{(1hr)}$: Neg: —; Mar: —; Crit: 10 ppm; Cat: —
PAC-1: 5.5 ppm; *PAC-2:* 10 ppm; *PAC-3:* 46 ppm
$Ceiling_{(ACGIH)}$: 0.3 ppm

Properties:

MW: 105.9	*VP:* 122 mmHg (77°F)	*FlP:* NA
D: 2.0 g/cm^3	*VD:* 3.6	*LEL:* NA
MP: 120°-124°F	*Vlt:* 120,000 ppm	*UEL*: NA
BP: Sublimes	*ER:* —	*RP:* 0.1
Vsc: —	*H_2O:* Soluble	*IP:* 11.84 eV
	Sol: Alcohols, ether	

C07-A003

Cyanogen Chloride (Agent CK)
CAS: 506-77-4
RTECS: GT2275000
UN: 1589; 125
EC: 208-052-8
UNII: 697I61NSA0
ICD-11: XM1293

ClCN

Colorless liquid or gas with a pungent, acrid, choking odor detectable at ≥1 ppm. Odor can go unnoticed because of discomfort. Used as an industrial fumigant and warning agent in odorless fumigant gases. It is used in metal cleaning, ore refining, and to produce malononitrile, s-triazines, and synthetic rubber.

Also reported as a mixture with Hydrogen cyanide (C07-A001); Arsenic trichloride (C04-C006).

This material is on Schedule 3 of the CWC, the DHS Chemicals of Interest list, Australia Chemicals of Security Concern list, and the ITF-25 Low Threat list.

Will polymerize during extended storage. Polymerization may be explosive.

Exposure Hazards

Conversion Factor: 1 ppm = 2.52 mg/m^3 at 77°F
$LCt_{50\ (Inh)}$: 11,000 mg-min/m^3 (2,200 ppm for a 2-minute exposure)
$ICt_{50\ (Inh)}$: 7,000 mg-min/m^3 (1,400 ppm for a 2-minute exposure)

These values are from older sources (circa 1937) and are not supported by modern data. No updated toxicity estimates have been proposed.

Eye Irritation: 4.8 ppm for a few seconds of exposure
Skin Irritation: 4.8 ppm for a 2-minute exposure

$MEG_{(1hr)}$: Neg: 0.30 ppm; Mar: 0.4 ppm; Crit: 4.0 ppm; Cat: —
PAC-1: 0.0050 ppm; *PAC-2:* 0.052 ppm; *PAC-3:* 4.0 ppm
$Ceiling_{(ACGIH)}$: 0.3 ppm
$Ceiling_{(NIOSH)}$: 0.3 ppm

Properties:

MW: 61.5	*VP:* 1,010 mmHg	*FlP:* NA
D: 1.2 g/mL	*VD:* 2.2	*LEL:* NA
MP: 20°F	*Vlt:* 1,400,000 ppm	*UEL*: NA
BP: 55°F	*H_2O:* 6.9%	*RP:* 0.01
Vsc: 0.34 cS (liq. gas, 77°F)	*ER:* 470	*IP:* 12.49 eV
	Sol: Most organic solvents	

C07-A004

Cyanogen Iodide
CAS: 506-78-5
RTECS: NN1750000
UN: —
EC: 208-053-3
UNII: 81ESV254UF
ICD-11: —

ICN
Colorless or white needle-shaped crystals with a pungent odor. Used as a preservative in taxidermy.

Exposure Hazards
Conversion Factor: 1 ppm = 6.25 mg/m^3 at 77°F
Respiratory/Eye Irritation: 100 mg/m^3; exposure duration unspecified
$MEG_{(1hr)}$: Neg: 88 mg/m^3; Mar: —; Crit: 180 mg/m^3; Cat: —
PAC-1: 5.6 ppm; *PAC-2:* 29 ppm; *PAC-3:* 46 ppm

Properties:

MW: 152.9	*VP:* 1 mmHg (77°F)	*FlP:* NA
D: 2.8 g/cm^3 (64°F)	*VD:* 5.3	*LEL:* NA
MP: 298°F	*Vlt:* 1,300 ppm	*UEL*: NA
BP: Sublimes	*ER:* —	*RP:* 8.2
Vsc: —	*H_2O:* Soluble	*IP:* 10.87 eV
	Sol: Ethanol, ether, volatile oils	

C07-A005

Cyanogen
CAS: 460-19-5
RTECS: GT1925000
UN: 1026; 119
EC: 207-306-5
UNII: 534Q0F66RK
ICD-11: XM1ZE4

NC–CN

Colorless gas with a pungent odor like almonds that is detectable at ≥230 ppm. Vapors are irritating at 15 ppm.

This material is on the DHS Chemicals of Interest list.

Exposure Hazards

Conversion Factor: 1 ppm = 2.13 mg/m^3 at 77°F

Based on available information, this agent appears to be approximately half as toxic as hydrogen cyanide (C07-A001).

MEG$_{(1hr)}$: Neg: 2.0 ppm; Mar: 8.5 ppm; Crit: 25 ppm; Cat: —
PAC-1: 2.0 ppm; *PAC-2:* 8.5 ppm; *PAC-3:* 25 ppm
REL: 10 ppm
Ceiling$_{(ACGIH)}$: 5 ppm

Final AEGLs
AEGL-1: 1 hr – 2.0 ppm; 4 hr – 1.3 ppm; 8 hr – 1.0 ppm
AEGL-2: 1 hr – 8.3 ppm; 4 hr – 4.3 ppm; 8 hr – 4.3 ppm
AEGL-3: 1 hr – 25 ppm; 4 hr – 13 ppm; 8 hr – 13 ppm

Properties:

MW: 52.0	*VP:* 3,800 mmHg	*FlP:* —
D: 0.87 g/mL (liq. gas, 77°F)	*VD:* 1.8	*LEL:* 6.6%
MP: -18°F	*Vlt:* 5,200,000 ppm	*UEL*: 32%
BP: -6°F	*ER:* 410	*RP:* NA
Vsc: 0.63 cS (liq. gas, 77°F)	*H_2O:* 1%	*IP:* 13.57 eV
	Sol: Alcohols, ether	

C07-A006

Hydrogen Sulfide (Agent NG)
CAS: 7783-06-4
RTECS: MX1225000
UN: 1053; 117
EC: 231-977-3
UNII: YY9FVM7NSN
ICD-11: XM7FL0

H_2S

Colorless gas with a strong odor of rotten eggs detectable at ≥0.005 ppm. However, can cause olfactory fatigue and sense of smell is not reliable. Used industrially to produce elemental sulfur, sulfuric acid, and heavy water for nuclear reactors.

Also reported as a mixture with chloropicrin (C10-A006) and carbon disulfide (C11-A033).
This material is on the ITF-25 high threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 1.40 mg/m^3 at 77°F
Eye Irritation: Low concentrations
Respiratory Irritation: 50 ppm; exposure duration unspecified
MEG$_{(1hr)}$: Neg: 0.51 ppm; Mar: 27 ppm; Crit: 50 ppm; Cat: —

PAC-1: 0.51 ppm; *PAC-2:* 27 ppm; *PAC-3:* 50 ppm
TLV: 1 ppm
$STEL_{(ACGIH)}$: 5 ppm
$Ceiling_{(OSHA)}$: 20 ppm
$Peak_{(OSHA)}$: 50 ppm 10-minute maximum
$Ceiling_{(NIOSH)}$: 10 ppm
IDLH: 100 ppm

Lethal human toxicity values have not been established or have not been published. However, based on available information, exposure to concentrations above 500 ppm can rapidly incapacitate and kill exposed individuals.

Final AEGLs
AEGL-1: 1 hr – 0.51 ppm; 4 hr – 0.36 ppm; 8 hr – 0.33 ppm
AEGL-2: 1 hr – 27 ppm; 4 hr – 20 ppm; 8 hr – 17 ppm
AEGL-3: 1 hr – 50 ppm; 4 hr – 37 ppm; 8 hr – 31 ppm

Properties:

MW: 34.1	*VP:* 13,376 mmHg	*FlP:* —
D: 0.78 g/mL (liq. gas, 77°F)	*VD:* 1.2	*LEL:* 4.0%
MP: -122°F	*Vlt:* NA	*UEL*: 44%
BP: -77°F	*ER:* 560	*RP:* NA
Vsc: 0.098 cS (liq. gas, 77°F)	*H_2O:* 0.4%	*IP:* 10.46 eV
	Sol: Gasoline, kerosene	

C07-C COMPONENTS AND PRECURSORS

C07-C007

Calcium Cyanide
CAS: 592-01-8
RTECS: EW0700000
UN: 1575; 157
EC: 209-740-0
UNII: 07DFJ2NTDD
ICD-11: XM42L1

$Ca(CN)_2$
White crystalline solid with an odor like bitter almond or peach kernels. It is hygroscopic and decomposes in moist air liberating hydrogen cyanide. Pure material is unstable. Commercial material may be a gray-black powder and contain significant sodium cyanide (C07-C009). This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

Used industrially for extraction of gold from ore, as a fumigant, insecticide and rodenticide, as a cement stabilizer, and in the preparation of ferrocyanides.

This material is the Australia Chemicals of Security Concern list.

Exposure Hazards

$MEG_{(1hr)}$: Neg: 3.8 mg/m^3; Mar: 13 mg/m^3; Crit: 28 mg/m^3; Cat: —
PAC-1: 3.8 mg/m^3; *PAC-2:* 13 mg/m^3; *PAC-3:* 28 mg/m^3
$Ceiling_{(ACGIH)}$: 5 mg/m^3 [Skin] (as cyanide)

Final AEGLs

AEGL-1: 1 hr – 3.8 mg/m^3; 4 hr – 2.4 mg/m^3; 8 hr – 1.9 mg/m^3
AEGL-2: 1 hr – 13 mg/m^3; 4 hr – 6.6 mg/m^3; 8 hr – 4.7 mg/m^3
AEGL-3: 1 hr – 28 mg/m^3; 4 hr – 16 mg/m^3; 8 hr – 12 mg/m^3

Properties:

MW: 92.1	*VP:* Negligible	*FlP:* NA
D: 1.9 g/cm^3	*VD:* —	*LEL:* NA
MP: 662°F (decomposes)	*Vlt:* NA	*UEL*: NA
BP: —	*ER:* NA	*RP:* NA
Vsc: —	*H_2O:* Soluble	*IP:* —
	Sol: Ethanol	

C07-C008

Potassium Cyanide

CAS: 151-50-8
RTECS: TS8750000
UN: 1680; 157
EC: 205-792-3
UNII: MQD255M2ZO
ICD-11: XM1VD7

KCN

White, granular or crystalline deliquescent solid that is odorless when dry but has a faint odor like almond when wet. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. It causes irritation of the eyes, skin, and upper respiratory system, asphyxia, lassitude, headache, confusion, nausea, vomiting, increased respiratory rate or slow gasping respiration, as well as thyroid and blood changes.

Used industrially for electroplating, precious metal extraction; and in the synthesis of dyes, pigments, pharmaceuticals, and pesticides.

This material is on the Australia Group Export Control list, DHS Chemicals of Interest list, Australia Chemicals of Security Concern list, and NRL Critical Threat list.

This material is a precursor to blood agents containing cyanide, many G-series nerve agents and other cyanide-containing agents.

Exposure Hazards

$LD_{50\ (Ing)}$: 0.2–0.3 g
$MEG_{(1hr)}$: Neg: 5.3 mg/m^3; Mar: 19 mg/m^3; Crit: 40 mg/m^3; Cat: —
PAC-1: 5.3 mg/m^3; *PAC-2:* 19 mg/m^3; *PAC-3:* 40 mg/m^3
PEL: 5 mg/m^3 (as cyanide)
$Ceiling_{(ACGIH)}$: 5 mg/m^3 [Skin] (as cyanide)

Ceiling$_{(NIOSH)}$: 5 mg/m^3 (as cyanide)
IDLH: 25 mg/m^3 (as cyanide)

Final AEGLs
AEGL-1: 1 hr – 5.3 mg/m^3; 4 hr – 3.5 mg/m^3; 8 hr – 2.7 mg/m^3
AEGL-2: 1 hr – 19 mg/m^3; 4 hr – 9.3 mg/m^3; 8 hr – 6.6 mg/m^3
AEGL-3: 1 hr – 40 mg/m^3; 4 hr – 23 mg/m^3; 8 hr – 18 mg/m^3

Properties:

MW: 65.1	*VP:* Negligible	*FlP:* NA
D: 1.6 g/cm^3	*VD:* —	*LEL:* NA
MP: 1,173°F	*Vlt:* NA	*UEL*: NA
BP: 2,957°F	*ER:* NA	*RP:* NA
Vsc: —	*H_2O:* 72% (77°F)	*IP:* —
	Sol: Glycerol, formamide, hydroxylamine	

C07-C009

Sodium Cyanide
CAS: 143-33-9
RTECS: VZ7525000
UN: 1689; 157
EC: 205-599-4
UNII: O5DDB9Z95G
ICD-11: XM1AZ9

NaCN
White, granular or crystalline deliquescent solid that is odorless when dry but has a faint odor like almond when wet. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. It causes irritation of the eyes and skin, asphyxia, lassitude, headache, confusion, nausea, vomiting, increased respiratory rate, slow gasping respiration, thyroid, and blood changes.

Used industrially for electroplating, precious metal extraction; and in the synthesis of dyes, pigments, pharmaceuticals, and pesticides.

This material is on the Australia Group Export Control list, DHS Chemicals of Interest list, FBI list, Australia Chemicals of Security Concern list, and NRL High Threat list.

This material is a precursor to blood agents containing cyanide, many G-series nerve agents and other cyanide-containing agents.

Exposure Hazards
LD$_{50\ (Ing)}$: 0.2–0.3 g
MEG$_{(1hr)}$: Neg: 4.0 mg/m^3; Mar: 14 mg/m^3; Crit: 30 mg/m^3; Cat: —
PAC-1: 4.0 mg/m^3; *PAC-2:* 14 mg/m^3; *PAC-3:* 30 mg/m^3
PEL: 5 mg/m^3 (as cyanide)
Ceiling$_{(ACGIH)}$: 5 mg/m^3 [Skin] (as cyanide)
Ceiling$_{(NIOSH)}$: 5 mg/m^3 (as cyanide)
IDLH: 25 mg/m^3 (as cyanide)

Properties:

MW: 49.0	*VP:* Negligible	*FlP:* NA
D: 1.6 g/cm^3	*VD:* —	*LEL:* NA
MP: 1,047°F	*Vlt:* NA	*UEL*: NA
BP: 2,725°F	*ER:* NA	*RP:* NA
Vsc: —	*H_2O:* 58% (77°F)	*IP:* —
	Sol: —	

C07-C010

Zinc Cyanide

CAS: 557-21-1
RTECS: ZH1575000
UN: 1713; 151
EC: 209-162-9
UNII: 04392RL5SR
ICD-11: —

$Zn(CN)_2$

Colorless or white powder with an odor like bitter almond or peach kernels. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

Used in metal plating; gold extraction; and as an insecticide.

This material is on the Australia Chemicals of Security Concern list.

Exposure Hazards

$MEG_{(1hr)}$: Neg: —; Mar: 23 mg/m^3; Crit: 110 mg/m^3; Cat: —
PAC-1: 14 mg/m^3; *PAC-2:* 18 mg/m^3; *PAC-3:* 110 mg/m^3

Properties:

MW: 117.4	*VP:* Negligible	*FlP:* NA
D: 1.9 g/cm^3	*VD:* —	*LEL:* NA
MP: 1,472°F (decomposes)	*Vlt:* NA	*UEL*: NA
BP: —	*ER:* NA	*RP:* NA
Vsc: —	*H_2O:* 5×10^{-4} %	*IP:* —
	Sol: Insoluble in alcohols	

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8 Arsine Blood Agents

GENERAL INFORMATION

These materials include arsine and reactive materials such as arsenide salts and alloys of arsenic that decompose to produce arsine. They were evaluated during World War I but have never been utilized on the battlefield. These materials are commercially available but are relatively difficult to disperse.

Although this class of agents is considered obsolete on the modern battlefield, arsine is still considered a significant threat as a potential improvised weapon that could be utilized in urban warfare or employed by terrorists.

TOXICOLOGY

Effects

Arsine affects the ability of the blood system to carry oxygen by destroying red blood cells. The lack of oxygen rapidly affects all body tissues, especially the central nervous system. Arsine may also affect the kidneys, liver, and heart. Most deaths related to arsine exposure are believed to be secondary to acute renal failure. Arsine is carcinogenic.

Pathways and Routes of Exposure

Arsine poses an inhalation hazard. However, reactive agents may also be hazardous through ingestion and abraded skin (e.g., breaks in the skin or penetration of skin by debris).

General Exposure Hazards

Arsine does not have good warning properties. Although it has a distinct odor, it is only detectable at levels higher than acceptable exposure limits. It does not irritate the eyes, respiratory system, or the skin.

The rate of detoxification of arsine by the body is very low. Exposures are essentially cumulative and may occur at levels below the odor threshold.

Latency Period

Effects from exposure to arsine can be delayed from 20 minutes up to 36 hours depending on the level of exposure.

CHARACTERISTICS

Physical Appearance/Odor

Laboratory Grade

Arsine is a colorless gas with a mild garlic-like odor. Reactive materials are solids that produce arsine on contact with water or acids.

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Binary Agents

Binary munitions that mix reactive solids with water or acids have been developed. Since the agent is formed just prior to or as a result of deployment, the product formed by mixing the components is crude and will consist of the solid agent, acid/water, and any by-products formed during the reaction. The color, odor, and consistency of the resulting mixture will vary depending on the quality of the components and the degree of mixing.

Stability

Arsine has a high vapor pressure and is difficult to store as a liquified gas. It is commercially available in pressure cylinders or as an adsorbed gas. It is extremely flammable and is also decomposed by light, heat, and contact with various metals. It can explode on contact with warm, dry air.

Reactive solids are stable when dry.

Persistency

Arsine is non-persistent and quickly dissipates or decomposes in the open environment. Solid agents will retain the potential to produce arsine (AsH_3) until they react with water or acid.

Environmental Fate

Due to the volatile nature of arsine, there is minimal extended risk except in an enclosed or confined space. Arsine vapor has a density greater than air and tends to collect in low places. It is soluble in water as well as aromatic and halogenated organic solvents.

Solid agents pose an extended risk because they retain the potential to produce arsine gas until they react with water or acids.

ADDITIONAL HAZARDS

Exposure

All foodstuffs in the area of a release should be considered contaminated with residual arsenic metal or oxides. Unopened items packaged in glass, metal, or heavy-duty plastic and exposed only to agent vapors may be used after decontamination of the container. Opened or unpackaged items, or those packaged only in paper or cardboard, should be destroyed.

Meat and milk from animals affected by arsine should be quarantined until tested. Exposed animals may not be suitable for consumption if they retain a sufficient body burden of arsenic.

Arsenic compounds can translocate from roots to other areas (e.g., leaves, fruit, etc.) of some plants. Plants, fruits, vegetables, and grains should be quarantined until tested.

Livestock/Pets

Animals can be decontaminated with shampoo/soap and water (see the decontamination section below). If the animal's eyes have been exposed to agent, they should be irrigated with water or saline solution for a minimum of 30 minutes.

The topmost layer of unprotected feedstock (e.g., hay or grain) should be destroyed. The remaining material should be quarantined until tested. In the event of a large release, arsenic metal or oxides from decomposed arsine could remain on leaves of forage vegetation until removed by precipitation. Arsenic compounds can also translocate from roots to leaves of some plants and could pose an ingestion hazard to livestock.

Fire

Arsine is a highly flammable gases that can form explosive mixtures with air. Hydrogen gas produced by photolytic decomposition of the agents may also be present. Actions taken to extinguish the fire can also spread the agent. Arsine is soluble in water and runoff from firefighting efforts could pose a significant threat. Solid agents will react with water to form arsine gas. Decomposition of the agents during a fire will produce poisonous arsenic oxides that may be present in smoke from the fire. Arsenic will also be deposited in the area downwind of the fire.

Reactivity

Arsine is incompatible with strong oxidizers and various metals including aluminum, copper, brass, and nickel. It may decompose on exposure to light to produce hydrogen gas and arsenic metal. In such a situation, the pressure inside a container can increase significantly; up to half again of the original pressure (i.e., two units of arsine gas produce three units of hydrogen gas).

Solid agents will react with water or acids to form arsine gas.

Hazardous Decomposition Products

Hydrolysis

Arsine produces arsenic acids and other arsenic products. Solid agents will react with water to form arsine gas.

Combustion

Volatile decomposition products include arsenic oxides. Arsine may decompose to hydrogen gas and arsenic metal if heated in a sealed container. In such a situation, the pressure inside the container can increase significantly; up to half again of the original pressure (i.e., two units of arsine gas produce three units of hydrogen gas).

PROTECTION

Evacuation Recommendations

Isolation and protective action distances listed below are taken from the 2020 Emergency Response Guidebook. Recommendations are based on a release scenario involving sabotage of a commercial container. A small release involves 200 kilograms (150 liters) of liquified gas and a large release involves 2,000 kilograms (1,500 liters) of liquified gas.

SA (Arsine) *C08-A001*

	Initial Isolation	Downwind Day	Downwind Night
Small device (200 kg)	300 m	1.9 km	5.7 km
Large device (2,000 kg)	1,000 m	8.9 km	11+ km

Personal Protective Requirements

Structural Firefighters' Gear

Structural firefighters' protective clothing is recommended for fire situations only; it is not effective in spill situations or release events. Although arsine is primarily an inhalation hazard,

decomposition products may pose a percutaneous risk. If chemical protective clothing is not available and it is necessary to rescue casualties from a contaminated area, then structural firefighters' gear will provide limited skin protection. Contact with solids and solutions should be avoided.

Respiratory Protection

Use a self-contained breathing apparatus (SCBAs). Air purifying respirators (APRs) are not recommended for use in an arsine atmosphere because of poor warning properties and the unknown effectiveness of sorbents used in the filters.

If APRs are used, then immediately dangerous to life or health (IDLH) levels are the ceiling limit for respirators other than SCBAs. Any exposures approaching the IDLH level should be regarded with extreme caution and the use of SCBAs for respiratory protection should be considered.

Chemical Protective Clothing

Use only chemical protective clothing that has undergone material and construction performance testing against arsine or against the reactive materials used to produce arsine.

Decontamination

General

Apply universal decontamination procedures using soap and water.

If reactive materials have been released, then care must be taken to compensate for the heat generated by their reaction with water. Take appropriate actions to disperse the arsine vapors that will be generated.

Vapors

Casualties/personnel

Remove all clothing as it may continue to emit trapped agent vapor after contact with the vapor cloud has ceased. Shower using copious amounts of soap and water. Ideally, showers will be high volume with low pressure. Ensure that the hair has been washed and rinsed to remove potentially trapped vapor. If eye irritation occurs, irrigate with water or 0.9% saline solution for a minimum of 15 minutes.

Small areas

Ventilate to remove the vapors. If decomposition to arsenic metal or arsenic oxides has occurred, wash the area with copious amounts of the soap and water. Collect and containerize the rinseate in containers lined with high-density polyethylene.

Reactive Solids

Casualties/personnel

Cover all open wounds during the decontamination process. Remove all clothing as it may contain residual solid. To avoid further exposure of the head, neck, and face to the agent, cut off potentially contaminated clothing that must be pulled over the head. Shower using copious amounts of soap and water. Ideally, showers will be high volume with low pressure. Care must be taken to avoid breathing any arsine generated during the decontamination process. Ensure that the hair has been washed and rinsed to remove potentially trapped vapor. If eye irritation occurs, irrigate with water or 0.9% saline solution for a minimum of 15 minutes.

Small areas

Collected the agent using a vacuum cleaner equipped with a high-efficiency particulate air (HEPA) filter. Place the collected material into containers lined with high-density polyethylene. Wash the area with copious amounts of the soap and water. Collect and containerize the rinseate in containers lined with high-density polyethylene. Ventilate the area to remove any agent vapors generated during the decontamination.

MEDICAL

CDC Case Definition

No specific biologic marker/test is available for arsine exposure; however, exposure might be indicated by detection of elevated arsenic levels in urine (>50 μg/l for a spot or >50 μg for a 24-hour urine), signs of hemolysis (e.g., hemoglobinuria, anemia, or low haptoglobin). The case can be confirmed if arsine is detected in environmental samples. The case can be confirmed if laboratory testing is not performed because either a predominant amount of clinical and nonspecific laboratory evidence is present or an absolute certainty of the etiology of the agent is known.

Differential Diagnosis

The following factors have been suggested as alternatives to consider when presented with a potential case of exposure to arsine: abdominal disorders such as gallbladder inflammation (cholecystitis), gallstones (cholelithiasis), biliary colic, kidney stones, and acute renal failure; blood disorders including acute anemia, methemoglobinemia, and hyperkalemia; diseases such as hepatitis, leptospirosis, malaria, and urinary tract infections; rhabdomyolysis, hemolytic uremic syndrome; cold agglutinin disease; and paroxysmal nocturnal hemoglobinuria; and also toxicity from smoke inhalation or exposure to toxic chemicals such as pyrogallic acid and stibine gas.

Signs and Symptoms

Unless high-dose exposure produces immediate fatality, exposure typically results in abdominal pain, blood in the urine (hematuria), and jaundice. Signs and symptoms due to massive hemolysis occur anywhere from 30 minutes to 24 hours post-exposure. Other potential symptoms include headache, a vague feeling of bodily discomfort (malaise), a feeling of weariness or diminished energy (lassitude), dizziness, difficulty in breathing (dyspnea), nausea, vomiting, dark urine, limited urine production (oliguria), bronze skin, yellow discoloration of the skin and eyes (jaundice), numbness, weakness, burning pain, loss of reflexes, delirium, memory loss, irritability, confusion, and dizziness.

Mass-Casualty Triage Recommendations

Priority 1

A casualty with abdominal pain, jaundice, red or discolored conjunctivae, breath with an odor of garlic, headache, severe thirst, fever, chills, and/or numb or cold extremities.

Priority 2

A casualty with a known exposure to arsine or who reports smelling a garlic or fishy odor.

Priority 3

Anyone with a potential exposure to arsine.

Priority 4

Unlikely classification for this agent.

Casualty Management

Remove casualty to fresh air and decontaminate with soap and water. If the casualty complains of eye irritation, irrigate the eyes with water or 0.9% saline solution for at least 15 minutes. If reactive materials were used, irrigate open wounds with water or 0.9% saline solution for at least 10 minutes.

Once the casualty has been decontaminated, medical personnel do not need to wear a chemical-protective mask.

Provide oxygen for respiratory distress. In severe cases, exchange blood transfusions may be required. There are no specific antidotes for arsine poisoning. The value of chelating agents to remove arsine has only been demonstrated in limited studies. However, chelating agents do not prevent hemolysis and may not provide any significant benefit in acute arsine toxicity.

FATALITY MANAGEMENT

Remove all clothing and personal effects and decontaminate with soap and water. If reactive materials have been used for the release, then arsine may be generated. Take appropriate actions to disperse the vapors.

Arsine is highly volatile and there is little risk of direct residual contamination. However, potential persistent decomposition products include arsenic and arsenic oxides. Wear appropriate respiratory and dermal protective clothing while washing the remains with soap and water. Pay particular attention to areas where agent may get trapped, such as hair, scalp, pubic areas, fingernails, folds of skin, and wounds. If remains are heavily contaminated with residue, wash and rinse waste should be contained for proper disposal. Once the remains have been thoroughly decontaminated, no further protective action is necessary. Body fluids removed during the embalming process do not pose any additional risks and should be contained and handled according to established procedures. Use standard burial procedures.

C08-A AGENTS

C08-A001

Arsine (Agent SA)
CAS: 7784-42-1
RTECS: CG6475000
UN: 2188; 119 / 3522; 173 (Absorbed)
EC: 232-066-3
UNII: V1I29R0RJQ
ICD-11: XM00Z1

AsH_3

Colorless gas with a mild odor described as fishy or like garlic. It is detectable at ≥0.5 ppm.

Decomposed by light, heat, and contact with various metals. Can explode on contact with warm, dry air. Ignites so easily that it cannot be disseminated by explosive shells.

Used as a doping agent for solid-state electronic components, in the preparation of gallium arsenide and glass dyes and in the manufacture of light-emitting diodes.

This material is on the Australia Chemicals of Security Concern list, ITF-25 High Threat list, and NRL Critical Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 3.19 mg/m^3 at 77°F

$LCt_{50\ (Inh)}$: 7,500 mg-min/m^3 (1,200 ppm for a 2-minute exposure). This a provisional update from an older value that have not been formally adopted.

$LC_{50\ (Inh)}$: 250 ppm for a 30-minute exposure.

$MEC_{(1hr)}$: Neg: 0.05 ppm; Mar: 0.16 ppm; Crit: 0.50 ppm; Cat: —

PAC-1: 0.015 ppm; *PAC-2:* 0.17 ppm; *PAC-3:* 0.50 ppm

PEL: 0.05 ppm

TLV: 0.005 ppm

$Ceiling_{(NIOSH)}$: 6 x 10^{-4} ppm

IDLH: 3 ppm

Final AEGLs

AEGL-1: Not Developed

AEGL-2: 1 hr – 0.17 ppm; 4 hr – 0.040 ppm; 8 hr – 0.020 ppm

AEGL-3: 1 hr – 0.50 ppm; 4 hr – 0.13 ppm; 8 hr – 0.060 ppm

Properties:

MW: 77.9	*VP:* 11,100 mmHg	*FlP:* —
D: 1.3 g/mL (liq. gas, 77°F)	*VD:* 2.7 (calculated)	*LEL:* 4.5%
MP: –179°F	*Vlt:* —	*UEL*: 78%
BP: –81°F	*ER:* 410	*RP:* 0.001
Vsc: 0.055 cS (liq. gas, 77°F)	*H_2O:* 20%	*IP:* 9.89 eV
	Sol: Benzene, chloroform	

C08-C COMPONENTS AND PRECURSORS

C08-C002

Aluminum Arsenide

CAS: 22831-42-1

RTECS: OM3570000

UN: —

EC: 245-255-0

UNII: —

ICD-11: —

AlAs

Gray to brown odorless powder. React with acids or moisture to produce arsine. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts.

Used industrially as a semiconductor and for the manufacture of light emitting diodes.

Exposure Hazards

Human toxicity values have not been established or have not been published.

Properties:

MW: 101.9	*VP:* —	*FlP:* —
D: 3.8 g/cm^3	*VD:* —	*LEL:* —

MP: 3,164°F
BP: —
Vsc: —
Vlt: —
ER: —
H_2O: Reacts
Sol: —
UEL: —
RP: —
IP: —

C08-C003

Calcium Arsenide

CAS: 12255-53-7
RTECS: —
UN: —
EC: 235-509-9
UNII: —
ICD-11: —

Ca_3As_2

Reddish-brown crystalline solid. Commercial material may appear white or gray. React with acids or moisture to produce arsine. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts.

Used industrially as a semiconductor and for the manufacture of light-emitting diodes. Has also been used as a fungicide and rodenticide.

Exposure Hazards

Human toxicity values have not been established or have not been published.

Properties:

MW: 270.1
D: 2.5 g/cm^3
MP: 1,542°F
BP: Sublimes
Vsc: —
VP: —
VD: —
Vlt: —
ER: —
H_2O: Reacts
Sol: —
FlP: —
LEL: —
UEL: —
RP: —
IP: —

C08-C004

Sodium Arsenide

CAS: 12044-25-6
RTECS: —
UN: —
EC: 234-952-5
UNII: —
ICD-11: —

Na_3As

Violet brown crystalline solid. React with acids or moisture to produce arsine. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts.

Used industrially as a semiconductor and for the manufacture of light-emitting diodes.

Exposure Hazards

Human toxicity values have not been established or have not been published.

Properties:

MW: 143.9	*VP:* —	*FlP:* —
D: 2.4 g/cm^3	*VD:* —	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: —	*ER:* —	*RP:* —
Vsc: —	*H_2O:* Reacts	*IP:* —
	Sol: —	

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9 Carbon Monoxide Blood Agents

GENERAL INFORMATION

These materials include carbon monoxide (C09-A001) and metal carbonyls that readily decompose to produce carbon monoxide. They were evaluated during World War I but largely abandoned because of the difficulty delivering an effective concentration of the agent on the battlefield. Between World War I and World War II, metal carbonyls were added to the fuels of flame weapons (e.g., flamethrowers) as a means of producing high levels of toxic carbon monoxide to augment their incendiary capabilities in situations involving soldiers occupying confined spaces such as caves and bunkers.

Although this class of agents is considered obsolete on the modern battlefield, they are still considered a significant threat as potential improvised weapons that could be utilized in urban warfare or employed by terrorists. They are commercially available but are relatively difficult to disperse over a large area.

TOXICOLOGY

Effects

Carbon monoxide affects the ability of the blood system to carry oxygen by binding to red blood cells, preventing the absorption and transport of oxygen by the blood. The lack of oxygen rapidly affects all body tissues, especially the central nervous system. In addition, metal carbonyls can cause pulmonary edema and may damage the liver and kidneys. Metal carbonyls are carcinogenic or are suspected human carcinogens.

Pathways and Routes of Exposure

Carbon monoxide (C09-A001) poses only an inhalation hazard. Metal carbonyls, however, are also hazardous through exposure of the skin and eye to either liquid or vapor, ingestion, and broken, abraded, or lacerated skin (e.g., penetration of skin by debris).

General Exposure Hazards

Carbon monoxide blood agents do not have good warning properties. Carbon monoxide is odorless and colorless. While exposure to metal carbonyl vapors can cause eye irritation, these concentrations are generally not low enough to provide good warning properties and prevent potentially hazardous exposure.

Lethal concentrations (LC_{50}s) for inhalation of carbon monoxide blood agents have not been fully established. However, immediately dangerous to life or health levels (IDLHs) for inhalation of these agents are as low as two parts per million.

Latency Period

Vapor/Aerosols (mists)

Depending on the concentration of agent vapor, the effects begin to appear 1 to 2 minutes after initial exposure. Inflammation of lung tissue (pneumonitis) or accumulation of fluid in the

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lungs (pulmonary edema) caused by inhalation of metal carbonyls may be delayed for several hours.

Liquid

Metal carbonyls cause immediate irritation and burning of the skin, eyes, mucous membrane, and respiratory system

CHARACTERISTICS

Physical Appearance/Odor

Laboratory Grade

Carbon monoxide is a colorless and odorless gas. Metal carbonyls are typically colorless liquids that may be odorless or have a faint musty smell.

Munition Grade

Munition grade metal carbonyls are typically yellow to dark-red liquids. Production impurities and decomposition products may cause the agents to darken and give them additional odors.

Mixtures with Other Agents

Metal carbonyls have been mixed with incendiary fuels to increase the production of carbon monoxide when the fuel is ignited and thereby increase the lethality of flame weapons when used in confined spaces such as caves and bunkers.

Stability

Carbon monoxide (C09-A001) is a stable gas. Metal carbonyls are relatively unstable and sensitive to light and moderately high temperatures. They may spontaneously ignite on contact with air. Volatile agents are stored in steel cylinders; otherwise, agents are stored in steel or glass containers. Metal carbonyls may be stored under an inert gas blanket, such as nitrogen, to prevent contact with the air.

Persistency

Carbon monoxide (C09-A001) is non-persistent and quickly dissipates in the open environment. Metal carbonyl are unstable and rapidly decompose to produce carbon monoxide and various metal oxides.

Environmental Fate

Due to the volatile nature of carbon monoxide (C09-A001), there is minimal extended risk except in an enclosed or confined space. Carbon monoxide vapor has a density only slightly less than air and does not tend to stratify significantly in confined spaces. It is insoluble in water but soluble in many organic solvents.

Metal carbonyl are unstable and are rapidly decomposed by air, light, and heat to produce carbon monoxide and various metal oxides. The vapors of unreacted carbonyls have a density greater than air and tend to collect in confined spaces. These materials are insoluble in water but soluble in many organic solvents.

ADDITIONAL HAZARDS

Exposure

In addition to tobacco smokers, individuals who have had previous exposure to materials containing methylene chloride (e.g., degreasers, solvents, paints removers, and furniture strippers), are at greater risk because of an existing body burden of carbon monoxide. Approximately one-fourth to one-third of inhaled methylene chloride vapor is metabolized in the liver to carbon monoxide. In addition, methylene chloride is readily stored in body tissue. This stored material is released over time and results in elevated levels of carbon monoxide for extended periods, in some cases more than twice as long as compared with direct carbon monoxide inhalation.

Carbon monoxide poses no significant residual risk. If metal carbonyls have been released, all foodstuffs in the area should be considered contaminated with residual metal decomposition products. Unopened items packaged in glass, metal, or heavy-duty plastic and exposed only to agent vapors may be used after decontamination of the container. Opened or unpackaged items, or those packaged only in paper or cardboard, should be destroyed.

Meat and milk from animals affected by metal carbonyls should be quarantined until tested for residual high levels of metals.

If metal carbonyls have been released, plants, fruits, vegetables, and grains should be quarantined until tested and determined to be safe to consume.

Livestock/Pets

Animals exposed to carbon monoxide do not require decontamination. If metal carbonyls have been released, animals can be decontaminated with shampoo/soap and water (see the decontamination section below). If the animal's eyes have been exposed to agent, they should be irrigated with water or saline solution for a minimum of 30 minutes.

Carbon monoxide poses no significant residual risk to feedstock (e.g., hay or grain). If metal carbonyls have been released, the topmost layer of unprotected feedstock should be destroyed. The remaining material should be quarantined until tested for metal residue. It is unlikely that sufficient residue would remain on leaves of forage vegetation to pose a significant threat.

Fire

All carbon monoxide blood agents are flammable and can form explosive mixtures with air. Metal carbonyls are highly flammable and may ignite spontaneously. Metal carbonyls decompose on heating to produce carbon monoxide. Although liquid agents are insoluble in water, actions taken to extinguish the fire can also spread the agent.

Reactivity

Metal carbonyls decompose in light to produce carbon monoxide. They are incompatible with strong oxidizers and readily form explosive mixtures with air. Some decomposes at ordinary temperatures in contact with porous materials (e.g., activated carbon used in air purifying respirator filters) and produce carbon monoxide.

Hazardous Decomposition Products

Hydrolysis

Metal carbonyls produce metal oxides when hydrolyzed.

Combustion

Metal carbonyl volatile decomposition products include carbon monoxide and metal oxides.

PROTECTION

Evacuation Recommendations

There are no published recommendations for isolation or protective action distances for carbon monoxide blood agents released in mass casualty situations. However, traditional isolation and protective action distances for these materials can be found in the Department of Transportation 2020 Emergency Response Guidebook. These recommendations are based upon an accidental release during transportation of the material and involving a small spill (i.e., a commercial gas cylinder or 208 liters or less of liquid material), or a large spill (i.e., more than one gas cylinder, a large gas container such as a railcar, or more than 208 liters of liquid material). In the event of terrorism, sabotage, or a catastrophic release of these materials, the Guidebook recommends doubling these distances.

Personal Protective Requirements

Structural Firefighters' Gear

Structural firefighters' protective clothing is recommended for fire situations only; it is not effective in spill situations or release events. Although carbon monoxide is primarily an inhalation hazard, metal carbonyls may pose a percutaneous risk. If chemical protective clothing is not available and it is necessary to rescue casualties from a contaminated area, then structural firefighters' gear will provide limited skin protection. Contact with liquids and solutions should be avoided.

Respiratory Protection

Use a self-contained breathing apparatus (SCBAs). Air purifying respirators (APRs) are not recommended for use in an atmosphere containing carbon monoxide or metal carbonyls because of poor warning properties and the unknown effectiveness of sorbents used in the filters.

If APRs are used, then immediately dangerous to life or health (IDLH) levels are the ceiling limit for respirators other than SCBAs. Any exposures approaching the IDLH level should be regarded with extreme caution and the use of SCBAs for respiratory protection should be considered.

Chemical Protective Clothing

Use only chemical protective clothing that has undergone material and construction performance testing against metal carbonyls. If the concentration of vapor exceeds the level necessary to produce effects through dermal exposure, then responders should wear a Level A protective ensemble.

In addition to the toxicological risk, high concentrations of metal carbonyls pose a significant fire/explosion hazard that may prevent safe entry even wearing the appropriate chemical protective apparel.

Decontamination

General (Metal Carbonyls)

Apply universal decontamination procedures using soap and water.

Vapors (Metal Carbonyls)

Casualties/personnel

Remove all clothing as it may continue to emit trapped agent vapor after contact with the vapor cloud has ceased. Shower using copious amounts of soap and water. Ideally, showers will be high volume with low pressure. Ensure that the hair has been washed and rinsed to remove potentially trapped vapor. If eye irritation occurs, irrigate with water or 0.9% saline solution for a minimum of 15 minutes.

Small areas

Ventilate to remove the vapors. If condensation is present, wash the area with copious amounts of the soap and water. Collect and containerize the rinseate in containers lined with high-density polyethylene. Ventilate the area to remove any agent vapors generated during the decontamination.

Liquids or Solutions (Metal Carbonyls)

Casualties/personnel

Cover all open wounds during the decontamination process. Remove all clothing immediately. Even clothing that has not come into direct contact with the agent may contain trapped vapor. To avoid further exposure of the head, neck and face to the agent, cut off potentially contaminated clothing that must be pulled over the head. Use a sponge or cloth with liquid soap and copious amounts of water to wash the skin surface and hair at least three times. Ideally, showers will be high volume with low pressure. Avoid rough scrubbing. Rinse with copious amounts of water. If water is not immediately available, the agent can be absorbed with any convenient material such as paper towels, toilet paper, flour, or talc. To minimize both spreading the agent and abrading the skin, do not rub the agent with the absorbent. Blot the contaminated skin with the absorbent. If there is a potential that the eyes have been exposed, irrigate with water or 0.9% saline solution for a minimum of 15 minutes.

Small areas

Ventilate to remove the vapors. Puddles of liquid can be contained by covering with absorbent material such as vermiculite, diatomaceous earth, clay, sponges, or towels. Place the absorbed material into containers lined with high-density polyethylene. Wash the area with copious amounts of the soap and water. Collect and containerize the rinseate. Ventilate the area to remove any agent vapors generated during the decontamination.

MEDICAL

CDC Case Definition

A case in which the carboxyhemoglobin concentration is higher than the normal reference range (i.e., greater than two percent for non-smokers and greater than nine percent for smokers) in venous or arterial blood is strongly supportive of a diagnosis of carbon monoxide poisoning.

Differential Diagnosis

The following factors have been suggested as alternatives to consider when presented with a potential case of exposure to carbon monoxide: diabetic ketoacidosis, hypothyroidism and myxedema coma, labyrinthitis, and lactic acidosis; toxic exposures resulting in methemoglobinemia; ingestion of alcohols or narcotics; and diseases that cause gastroenteritis, encephalitis, meningitis, and acute respiratory distress syndrome.

Signs and Symptoms

Vapors/Aerosols

Headache, rapid breathing (tachypnea), dizziness, confusion, and chest pain. The casualty may also experience palpitations, difficulty breathing (dyspnea) on exertion, drowsiness, lack of energy (lethargy), hallucination, agitation, nausea, vomiting, diarrhea, and coma. If metal carbonyls have been released, there may be complaints of irritation of the eyes, mucous membrane, and respiratory system. Inflammation of lung tissue (pneumonitis) caused by metal carbonyls can may be delayed 12 to 36 hours. They may also cause injury to the liver, kidneys, and lungs as well as degenerative changes in the central nervous system.

Liquids

Irritation and burning of the skin, eyes, mucous membrane, and respiratory system.

Mass-Casualty Triage Recommendations

Priority 1

A casualty with a heartbeat but is unconscious, not breathing and has low blood pressure.

Priority 2

A casualty with known exposure to carbon monoxide blood agents who was initially unconscious but has regained consciousness, or a casualty who shows neurological abnormalities such as dizziness, confusion, or hallucinations; has cardiac arrhythmias, bronchospasm, or complains of severe headache, difficulty breathing, or chest pain. If available, breath measurement indicates the blood carbon monoxide level exceeds 20%.

Priority 3

A casualty with known or potential exposure to carbon monoxide blood agents but who shows no signs of neurological or cardiac abnormalities, and does not complain of discomfort (e.g., headache, difficulty breathing, etc.). If available, breath measurement indicates the blood carbon monoxide level is less than 10%. Anyone with potential exposure to metal carbonyls should be transported to a medical facility for evaluation because of the risk of latent chemical pneumonitis from inhalation of these agents.

Priority 4

A casualty with known exposure to carbon monoxide blood agents and in cardiac arrest.

Casualty Management

Remove casualty to fresh air and decontaminate with soap and water. Provide oxygen for respiratory distress. If the casualty complains of eye irritation, irrigate with water or 0.9% saline solution for at least 15 minutes. If metal carbonyls were used, irrigate open wounds with water or 0.9% saline solution for at least 10 minutes.

Once the casualty has been decontaminated, medical personnel do not need to wear a chemical-protective mask.

Continue oxygen therapy until patient is asymptomatic and blood carbon monoxide levels are below nine percent. For individuals with blood carbon monoxide levels above 40%, consider transfer to a hyperbaric facility.

If metal carbonyls were used, asymptomatic individuals should be monitored for possible complications caused by inflammation of lung tissue (pneumonitis) or accumulation of fluid in the lungs (pulmonary edema).

FATALITY MANAGEMENT

Remove all clothing and personal effects and decontaminate with soap and water.

Most carbon monoxide blood agents are highly volatile and there is little risk of direct residual contamination. Wash the remains with soap and water. However, if iron pentacarbonyl was the agent involved, wear appropriate respiratory and dermal protective clothing while washing the remains with soap and water. In all cases, pay particular attention to areas where agent may get trapped, such as hair, scalp, pubic areas, fingernails, folds of skin, and wounds. Once the remains have been thoroughly decontaminated, no further protective action is necessary. Body fluids removed during the embalming process do not pose any additional risks and should be contained and handled according to established procedures. Use standard burial procedures.

C09-A AGENTS

C09-A001

Carbon Monoxide

CAS: 630-08-0

RTECS: FG3500000

UN: 1016; 119 / 9202; 168 (Cryogenic)

EC: 211-128-3

UNII: 7U1EE4V452

ICD-11: XM3PB9

CO

Colorless odorless gas. Used as a reducing agent in metallurgical operations and to manufacture metal carbonyls.

This material is on the DHS Chemicals of Interest list, Australia Chemicals of Security Concern list, and ITF-25 Medium Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 1.15 mg/m^3 at 77°F

$LC_{50\ (Inh)}$: 6,400 ppm. Headache and dizziness in 1 to 2 minutes followed by unconsciousness. Death in 10 to 15 minutes with continued exposure.

$LC_{50\ (Inh)}$: 12,800 ppm. Immediate unconsciousness. Death in 1 to 3 minutes with continued exposure.

$MEG_{(1hr)}$: Neg: —; Mar: 83 ppm; Crit: 330 ppm; Cat: —

PAC-1: 75 ppm; *PAC-2:* 83 ppm; *PAC-3:* 330 ppm

PEL: 50 ppm

REL: 35 ppm

TLV: 25 ppm

$Ceiling_{(NIOSH)}$: 200 ppm

IDLH: 1,200 ppm

Final AEGLs

AEGL-1: Not Developed

AEGL-2: 1 hr – 83 ppm; 4 hr – 33 ppm; 8 hr – 27 ppm

AEGL-3: 1 hr – 330 ppm; 4 hr – 150 ppm; 8 hr – 130 ppm

Properties:

MW: 28.0	*VP:* >26,600 mmHg	*FlP:* –312°F
D: 0.62 g/mL (liq. gas, –256°F)	*VD:* 0.97	*LEL:* 12.5%
MP: –337°F	*Vlt:* NA	*UEL*: 74%
BP: –313°F	*ER:* 210	*RP:* NA
Vsc: 0.097 cS (liq. gas, –238°F)	*H_2O:* 2%	*IP:* 14.01 eV
	Sol: Alcohol, benzene, chloroform	

C09-A002

Iron Pentacarbonyl

CAS: 13463-40-6
RTECS: NO4900000
UN: 1994; 131
EC: 236-670-8
UNII: 6WQ62TAQ6Z
ICD-11: —

$Fe(CO)_5$

Colorless to yellow to dark-red, odorless, oily liquid. Used to manufacture finely divided iron for high-frequency radio and television coils.

May spontaneously ignite on contact with air (>122°F). Decomposes on heating or in light, producing carbon monoxide (C09-A001).

This material is on the DHS Chemicals of Interest list and ITF-25 Low Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 8.01 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: —; Mar: 0.060 ppm; Crit: 0.17 ppm; Cat: —
PAC-1: 0.0055 ppm; *PAC-2:* 0.060 ppm; *PAC-3:* 0.17 ppm
REL: 0.35 ppm (as iron)
TLV: 0.1 ppm (as iron)
$STEL_{(ACGIH)}$: 0.2 ppm (as iron)
$STEL_{(NIOSH)}$: 0.7 ppm (as iron)
IDLH: 1.4 ppm (as iron)

Final AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 0.060 ppm; 4 hr – 0.037 ppm; 8 hr – 0.025 ppm
AEGL-3: 1 hr – 0.18 ppm; 4 hr – 0.11 ppm; 8 hr – 0.075 ppm

Properties:

MW: 195.9	*VP:* 40 mmHg (87°F)	*FlP:* 5°F
D: 1.5 g/mL	*VD:* 6.8 (calculated)	*LEL:* 3.7%
MP: –6°F	*Vlt:* 52,000 ppm	*UEL*: 12.5%
BP: 217°F (749 mmHg)	*ER:* 180	*RP:* 0.2
Vsc: —	*H_2O:* Insoluble	*IP:* 7.98 eV
	Sol: Most organic solvents	

C09-A003

Nickel Carbonyl
CAS: 13463-39-3
RTECS: QR6300000
UN: 1259; 131
EC: 236-669-2
UNII: 1ZYL78UWZN
ICD-11: XM9P91

$Ni(CO)_4$
Colorless to yellow liquid with a musty or sooty odor detectable at ≥3 ppm. Intermediate in nickel refining.

May spontaneously ignite or explode on contact with air (>140°F). Decomposes on heating or on contact with acids to produce carbon monoxide (C09-A001).

Used to produce high-purity nickel powder and to coat metals with nickel.
This material is on the DHS Chemicals of Interest list.

Exposure Hazards
Conversion Factor: 1 ppm = 6.98 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: —; Mar: 0.036 ppm; Crit: 0.16 ppm; Cat: —
PAC-1: 0.0033 ppm; *PAC-2:* 0.036 ppm; *PAC-3:* 0.16 ppm
PEL: 0.001 ppm
REL: 0.001 ppm
$Ceiling_{(ACGIH)}$: 0.05 ppm
IDLH: 2 ppm

Final AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 0.036 ppm; 4 hr – 0.0090 ppm; 8 hr – 0.0045 ppm
AEGL-3: 1 hr – 0.16 ppm; 4 hr – 0.040 ppm; 8 hr – 0.020 ppm

Properties:

MW: 170.7	*VP:* 480 mmHg	*FlP:* –11°F
D: 1.3 g/mL (77°F)	*VD:* 5.9 (calculated)	*LEL:* 2%
MP: –13°F	*Vlt:* 420,000 ppm	*UEL*: 34%
BP: 110°F	*ER:* 190	*RP:* 0.02
Vsc: 0.38 cS (77°F)	H_2O: 0.05%	*IP:* 8.28 eV
	Sol: Alcohol, benzene, acetone	

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10 Pulmonary Agents

GENERAL INFORMATION

The agents in this class cover a wide variety of chemical structures including halogens, acyl halides, various alkylating agents, as well as metallic and nonmetallic oxides. The majority of these agents were evaluated and used during World War I. Research into more effective pulmonary agents continued through World War II. Various metals (e.g., cadmium and selenium) were added to the fuels of flame weapons (e.g., flamethrowers) as a means of producing high concentrations of toxic metal fume in hard-to-assault fortifications such as caves and bunkers. Perfluoroisobutylene (C10-A008) is listed in Schedule 2 of the Chemical Weapons Convention. Chloropicrin (C10-A006) and phosgene (C10-A003) are listed in Schedule 3. Pulmonary agents are relatively easy to acquire and disperse.

Pulmonary agents have been stockpiled by most countries that have pursued a chemical weapons program, and have been used a number of times on the battlefield. Although this class of agents is considered obsolete on the modern battlefield, several of these agents are still considered a significant threat as potential improvised weapons that could be utilized in urban warfare or employed by terrorists.

TOXICOLOGY

Effects

Pulmonary agents are primarily respiratory irritants. In extreme cases, membranes swell, lungs become filled with liquid (pulmonary edema), and death results from lack of oxygen. Some agents can also pass through the skin to induce systemic intoxication. In high concentrations, chlorine (C10-A001), bromine (C10-A002), and chloropicrin (C10-A006) pose a dermal hazard and can produce local blistering and corrosion. Several agents in this class are carcinogenic.

Pathways and Routes of Exposure

Pulmonary agents are primarily an inhalation hazard. However, at high concentration, agents and decomposition products may exhibit some corrosive properties on the skin. Exposure of the eyes and skin to halogens can produce local blistering and corrosion. Some agents also pass through the skin to induce systemic intoxication.

General Exposure Hazards

As a class, pulmonary agents do not have good warning properties. However, halogens and some alkylating agents will produce eye and skin irritation at low levels.

Lethal concentrations (LC_{50}s) for inhalation of these agents are as low as 93 parts per million for a 2-minute exposure.

Latency Period

Vapor/Aerosols

Pulmonary effects are usually delayed from 2 to 24 hours. Exposure to very high concentrations may produce immediate symptoms. Generally, the more rapid the onset of symptoms, the graver the prognosis.

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CHARACTERISTICS

Physical Appearance/Odor

Laboratory Grade

Most pulmonary agents are either volatile liquids or gases. These agents are typically colorless. Odors, if present, vary from mildly pleasant to harsh and irritating. Some agents, especially in high concentration, may cause eye irritation and tearing.

Metal fume agents are odorless solids dispersed as aerosols from incendiary devices. Depending on various factors, the aerosol may or may not be visible.

Modified Agents

Pulmonary agents have been absorbed into porous powders (e.g., pumice) and disseminated as dust clouds. The agents are then slowly released by the dust particles, thereby greatly increasing the persistency of the agents.

Some pulmonary agents are stored and shipped as concentrated solutions to facilitate handling and stabilize the agents. Odors will vary depending on the characteristics of the solvent(s) used and concentration of pulmonary agent in the solution.

Mixtures with Other Agents

During World War 1, pulmonary agents were sometimes mixed with various reactive metal chlorides (e.g., stannous chloride) to produce a visible cloud that allowed observers to track the progress of the attack. At other times, these agents were mixed with arsenical vesicants (C04) to add a dermal threat to the attack.

Stability

Pulmonary agents are stable when stored dry. If moisture is present, many agents will decompose to acid products that will corrode iron, steel, and other metal. Many commercially available gases are shipped in a compressed, liquified form. Some agents, such as phosgene (C10-A003), can be found commercially as highly concentrated solutions of the gas dissolved in an organic solvent, or are shipped as an adsorbed gas.

Persistency

For military purposes, pulmonary agents are classified as non-persistent. Most pulmonary agents are either volatile liquids or gases. Aerosols of nonvolatile agents are not persistent. Cold weather may decrease the rate of volatilization of liquid and solid agents and increase their persistency. Agents absorbed into porous powders may be significantly more persistent than normal. These powders can be re-aerosolized after deployment by ground traffic or strong winds. Decomposition products from the breakdown of some agents can pose a persistent hazard.

Environmental Fate

Due to the volatile nature of most pulmonary agents, there is minimal extended risk except in an enclosed or confined space. Vapors have a density greater than air and tend to collect in low places. Solids that are dispersed as aerosols have little or no vapor pressure. Once the aerosols settle, there is minimal extended hazard from the agents unless the dust is re-suspended.

Pulmonary agents have limited solubility in water and many decompose rapidly in contact with moisture (e.g., high humidity) or with water.

ADDITIONAL HAZARDS

Exposure

If low volatility agent aerosols or metal fumes have been released, all foodstuffs in the area should be considered contaminated. Unopened items packaged in glass, metal, or heavy-duty plastic may be used after decontamination of the container. Opened or unpackaged items, or those packaged only in paper or cardboard, should be destroyed.

Meat and milk from animals affected by metal fumes should be quarantined until tested for residual high levels of metals. Plants, fruits, vegetables, and grains should be quarantined until tested and determined to be safe to consume.

Livestock/Pets

Animals exposed to volatile pulmonary agents do not require decontamination. If low volatility agent aerosols have been released, animals can be decontaminated with shampoo/soap and water (see the decontamination section below). If the animal's eyes have been exposed to agent, they should be irrigated with water or saline solution for a minimum of 30 minutes.

If low volatility agent aerosols or metal fumes have been released, the topmost layer of unprotected feedstock (e.g., hay or grain) should be destroyed. The remaining material should be quarantined until tested for residue. It is unlikely that sufficient residue would remain on leaves of forage vegetation to pose a significant threat.

Fire

Most pulmonary agents are either non-flammable or difficult to ignite. Some are strong oxidizers and will support combustion. Agents may be decomposed by heat to produce other toxic and/or corrosive gases. They may react with steam or water during a fire to produce toxic and/or corrosive gases. Although pulmonary agents have limited solubility in water, actions taken to extinguish the fire can spread the agent.

Reactivity

Many of these agents are incompatible with acids, bases, reducing agents, and other flammable materials. Some agents, such as chloropicrin (C10-A006) and chlorine trifluoride (C10-A015) are incompatible with oxidizers. Most pulmonary agents react with water to form acidic products.

Hazardous Decomposition Products

Hydrolysis

Most pulmonary agents produce corrosive decomposition products that may include hydrogen chloride (HCl), hydrogen bromide (HBr), hydrogen fluoride (HF), and/or hydrogen cyanide (HCN). Agents with metal halide additives will also form potentially toxic metallic oxides.

Combustion

Volatile decomposition products may include hydrogen chloride (HCl), hydrogen bromide (HBr), hydrogen fluoride (HF), and/or hydrogen cyanide (HCN). Agents containing metals will produce metallic oxides.

PROTECTION

Evacuation Recommendations

Isolation and protective action distances listed below are taken from the 2020 Emergency Response Guidebook. For pulmonary agents, these recommendations are based on two different release mechanisms (i.e., direct aerosolization of liquid agents or sabotage of commercial containers) as well as various quantities of material depending on the agent used in the release.

For CG, the release scenario involves sabotage of a commercial container with either 20 kilograms (approximately 14 liters) of liquified gas or 3,600 kilograms (approximately 2,600 liters) of liquified gas.

For DP, the release involves direct aerosolization of the liquid agent with a particle size between 2 and 10 microns. A small release involves 30 kilograms (approximately 18 liters) of liquid agent and a large release involves 500 kilograms (approximately 290 liters) of liquid agent.

DP (Diphosgene) *C10-A004*

	Initial Isolation	Downwind Day	Downwind Night
Small device (30 kg)	30 m	0.2 km	0.7 km
Large device (500 kg)	200 m	1.0 km	2.4 km

CG (Phosgene) *C10-A003*

	Initial Isolation	Downwind Day	Downwind Night
Small device (20 kg)	150 m	0.8 km	3.2 km
Large device (3,600 kg)	1,000 m	7.5 km	11+ km

Personal Protective Requirements

Structural Firefighters' Gear

Pulmonary agents are primarily a respiratory hazard; however, solids, liquids or high vapor concentrations of some agents may pose an eye/skin hazard. Structural firefighters' protective clothing is recommended for fire situations only; it is not effective in spill situations or release events. If chemical protective clothing is not available and it is necessary to rescue casualties from a contaminated area, then structural firefighters' gear will provide limited skin protection against agent vapors. Contact with liquids, solids, and solutions should be avoided.

Respiratory Protection

Self-contained breathing apparatuses (SCBAs) or air purifying respirators (APRs) should have a National Institute for Occupational Safety and Health (NIOSH) Chemical/Biological/Radiological/Nuclear (CBRN) certification. However, during emergency operations, other NIOSH-approved SCBAs or APRs that have been specifically tested by the manufacturer against chemical warfare agents may be used if deemed necessary by the incident commander. APRs should be equipped with a NIOSH-approved CBRN filter or a combination organic vapor/acid gas/particulate cartridge.

Air purifying respirators (APRs) are not recommended for use in an atmosphere containing perfluoroisobutylene (C10-A008) because of poor warning properties of the agent and a short life span of respirator cartridges.

Immediately dangerous to life or health (IDLH) levels are the ceiling limit for respirators other than SCBAs. Any exposures approaching the IDLH level should be regarded with extreme caution and the use of SCBAs for respiratory protection should be considered.

Chemical Protective Clothing

Use only chemical protective clothing that has undergone material and construction performance testing against pulmonary agents, particularly those that pose a dermal hazard such as halogens. If the concentration of vapor exceeds the level necessary to produce effects through dermal exposure, then responders should wear a Level A protective ensemble. Since chemical protective clothing is tested against laboratory grade agents, reported permeation rates may be affected by solvents if solutions of agents have been released.

Decontamination

General

Apply universal decontamination procedures using soap and water.

Vapors

Casualties/personnel

Remove all clothing as it may continue to emit trapped agent vapor after contact with the vapor cloud has ceased. Shower using copious amounts of soap and water. Ideally, showers will be high volume with low pressure. Ensure that the hair has been washed and rinsed to remove potentially trapped vapor. If eye irritation occurs, irrigate with water or 0.9% saline solution for a minimum of 15 minutes.

Small areas

Ventilate to remove the vapors.

Liquids, Solutions, or Liquid Aerosols

Casualties/personnel

Cover all open wounds during the decontamination process. Remove all clothing immediately. Even clothing that has not come into direct contact with the agent may contain trapped vapor. To avoid further exposure of the head, neck and face to the agent, cut off potentially contaminated clothing that must be pulled over the head. Use a sponge or cloth with liquid soap and copious amounts of water to wash the skin surface and hair at least three times. Ideally, showers will be high volume with low pressure. Avoid rough scrubbing. Rinse with copious amounts of water. If water is not immediately available, the agent can be absorbed with any convenient material such as paper towels, toilet paper, flour, talc, etc. To minimize both spreading the agent and abrading the skin, do not rub the agent with the absorbent. Blot the contaminated skin with the absorbent. If there is a potential that the eyes have been exposed, irrigate with water or 0.9% saline solution for a minimum of 15 minutes.

Small areas

Ventilate to remove the aerosol. Puddles of liquid can be contained by covering with absorbent material such as vermiculite, diatomaceous earth, clay, sponges, or towels. Place the absorbed material into containers lined with high-density polyethylene. Wash the area with copious amounts of the soap and water. Collect and containerize the rinseate. Ventilate the area to remove residual vapors.

Solids or Particulate Aerosols

Casualties/personnel

Do not attempt to brush the agent off of the individual or their clothing as this can aerosolized the agent. Cover all open wounds during the decontamination process. If possible, dampen the agent

with a water mist to help prevent aerosolization. Remove all clothing immediately. To avoid further exposure of the head, neck and face to the agent, cut off potentially contaminated clothing that must be pulled over the head. Wash the skin surface and hair at least three times with copious amounts of soap and water. Ideally, showers will be high volume with low pressure. Do not delay decontamination to find warm or hot water if it is not readily available. Rinse with copious amounts of water. If there is a potential that the eyes have been exposed, irrigate with water or 0.9% saline solution for a minimum of 15 minutes.

Small areas

If indoors, close windows and doors in the area and turn off anything that could create air currents (e.g., fans, air conditioner, etc.). Allow aerosol to settle. Avoid actions that could aerosolize the agent such as sweeping or brushing. Collected the agent using a vacuum cleaner equipped with a high-efficiency particulate air (HEPA) filter. Do not use a standard home or industrial vacuum. Do not allow the vacuum exhaust to stir the air in the affected area. Vacuum all surfaces with extreme care in a very slow and controlled manner to minimize aerosolizing the agent. Place the collected material into containers lined with high-density polyethylene. Wash the area with copious amounts of the soap and water. Collect and containerize the rinseate in containers lined with high-density polyethylene. Ventilate the area to remove any agent vapors generated during the decontamination.

MEDICAL

CDC Case Definition

No specific biologic marker/test is available for pulmonary agents as a class; however, exposure to bromine (C10-A002) might be indicated by detection of elevated bromide levels in serum (reference level 50–100 mg/L). The case can be confirmed if chlorine (C10-A001) or bromine are detected in environmental samples. The case can be confirmed if laboratory testing is not performed by either a predominant amount of clinical and nonspecific laboratory evidence is present or an absolute certainty of the etiology of the agent is known.

Differential Diagnosis

The following factors have been suggested as alternatives to consider when presented with a potential case of exposure to pulmonary agents: bronchitis; asthma; bacterial or viral pneumonia; congestive heart failure with pulmonary edema; acute coronary syndrome; acute respiratory distress syndrome; pulmonary embolism; smoke inhalation; bronchial/pulmonary burns; toxic exposures resulting in methemoglobinemia; salicylate overdose; exposure to carbamate or organophosphate pesticides; inhalation of corrosive gases such as ammonia, hydrogen chloride, and hydrogen fluoride or corrosive oxides such as those produced by fires involving sulfur or phosphorous; inhalation of hydrocarbon insecticides, carbon monoxide, or hydrogen sulfide.

Signs and Symptoms

Vapors

Exposure to low concentrations of pulmonary agents may not produce immediate effects. However, the severity of poisoning is not related to the presentation or magnitude of immediate symptoms. Symptoms may include headache, nausea, vomiting, eye and airway irritation, tearing (lacrimation), difficulty breathing (dyspnea), coughing, wheezing, chest tightness, and delayed accumulation of fluid in the lungs (pulmonary edema). If chlorine (C10-A001), bromine (C10-A002), chlorine

trifluoride (C10-A015), or chloropicrin (C10-A006) have been released, there may be redness of the skin or chemical burns.

Liquids

Irritation and burning of the skin, eyes, mucous membrane, and respiratory system. Direct contact may result in chemical burns.

Mass-Casualty Triage Recommendations

Priority 1

A casualty with signs of pulmonary edema within 4 to 6 hours post-exposure but no further complications.

Priority 2

A casualty with onset of symptoms more than 4 hours post-exposure, or with difficulty breathing without objective signs. Observe closely and retriage hourly. After 12 hours, retriage every 2 hours.

Priority 3

An asymptomatic casualty with known or potential exposure to pulmonary agents. Observe closely and retriage every 2 hours for at least 6 hours before discharge.

Priority 4

A casualty with onset of symptoms (pulmonary edema, cyanosis and hypotension; or persistent hypotension despite intensive medical care) less than 4 hours post-exposure. This triage classification is resource dependent.

Casualty Management

Remove casualty to fresh air and decontaminate with soap and water. Provide oxygen for respiratory distress. If the casualty complains of eye irritation, irrigate the eyes with water or 0.9% saline solution for at least 15 minutes. If solid or liquid agents were used, irrigate open wounds with water or 0.9% saline solution for at least 10 minutes.

Once the casualty has been decontaminated, medical personnel do not need to wear a chemical-protective mask.

There is no antidote for exposure to these agents. Enforce rest as even minimal physical exertion may shorten the clinical latent period. Asymptomatic individuals suspected of exposure to pulmonary agents should be monitored for possible complications caused by accumulation of fluid in the lungs (pulmonary edema) for at least 6 hours. Chelation therapy may be appropriate to minimize systemic toxicity if metal fumes have been released.

FATALITY MANAGEMENT

Remove all clothing and personal effects and decontaminate with soap and water.

Pulmonary agents pose little risk of direct residual contamination. Wash the remains with soap and water. Pay particular attention to areas where agent may get trapped, such as hair, scalp, pubic areas, fingernails, folds of skin, and wounds. Once the remains have been thoroughly decontaminated, no further protective action is necessary. Body fluids removed during the embalming process do not pose any additional risks and should be contained and handled according to established procedures. Use standard burial procedures.

C10-A AGENTS

C10-A001

Chlorine (Agent CL)
CAS: 7782-50-5
RTECS: FO2100000
UN: 1017; ERG: 124 / 3520; 173 (Absorbed)
EC: 231-959-5
UNII: 4R7X1O2820
ICD-11: XM0GT6

Cl_2
Yellow-green gas with a pungent, irritating odor detectable at ≥0.01 ppm. The cloud is invisible below a concentration of approximately 1%.

Also reported as a mixture with sulfur monochloride (C03-C038); phosgene (C10-A003); chloropicrin (C10-A006).

This material is on the DHS Chemicals of Interest list, Australia Chemicals of Security Concern list, ITF-25 High Threat list, and NRL High Threat list.

Exposure Hazards
Conversion Factor: 1 ppm = 2.90 mg/m^3 at 77°F
$LCt_{50\ (Inh)}$: 19,000 mg-min/m^3 (3,200 ppm for a 2-minute exposure)
$ICt_{50\ (Inh)}$: 1,800 mg-min/m^3 (310 ppm for a 2-minute exposure)
$MEG_{(1hr)}$: Neg: 0.52 ppm; Mar: 2.0 ppm; Crit: 20 ppm; Cat: —
PAC-1: 0.48 ppm; *PAC-2:* 2.0 ppm; *PAC-3:* 20 ppm
TLV: 0.1 ppm
$STEL_{(ACGIH)}$: 0.4 ppm
$Ceiling_{(OSHA)}$: 1 ppm
$Ceiling_{(NIOSH)}$: 0.5 ppm
IDLH: 10 ppm

Final AEGLs
AEGL-1: 1 hr – 0.50 ppm; 4 hr – 0.50 ppm; 8 hr – 0.50 ppm
AEGL-2: 1 hr – 2.0 ppm; 4 hr – 1.0 ppm; 8 hr – 0.71 ppm
AEGL-3: 1 hr – 20 ppm; 4 hr – 10 ppm; 8 hr – 7.1 ppm

Properties:

MW: 70.9	*VP:* 4,992 mmHg	*FlP:* NA
D: 1.4 g/mL (liq. gas, 77°F)	*VD:* 2.5	*LEL:* NA
MP: –150°F	*Vlt:* —	*UEL*: NA
BP: –29°F	*ER:* 480	*RP:* 0.002
Vsc: 0.25 cS (liq. gas, 77°F)	*H_2O:* 0.7%	*IP:* 11.48 eV
	Sol: Alcohols	

C10-A002

Bromine
CAS: 7726-95-6
RTECS: EF9100000

UN: 1744; 154
EC: 231-778-1
UNII: SBV4XY874G
ICD-11: XM3GS6

Br_2

Dark reddish-brown, fuming liquid with a suffocating, irritating odor detectable at ≥3.5 ppm.

This material is on the DHS Chemicals of Interest list, Australia Chemicals of Security Concern list, ITF-25 Low Threat list and NRL Critical Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 6.54 mg/m^3 at 77°F
$LC_{50\ (Inh)}$: 200 mg/m^3 (31 ppm) is fatal in a very short time
Eye Irritation: 0.32 ppm; exposure duration unspecified
Respiratory Irritation: 1.7–3.5 ppm produce severe choking
$MEG_{(1hr)}$: Neg: 0.030 ppm; Mar: 0.24 ppm; Crit: 8.6 ppm; Cat: —
PAC-1: 0.034 ppm; *PAC-2:* 0.24 ppm; *PAC-3:* 8.6 ppm
PEL: 0.1 ppm
REL: 0.1 ppm
TLV: 0.1 ppm
$STEL_{(ACGIH)}$: 0.2 ppm
$STEL_{(NIOSH)}$: 0.3 ppm
IDLH: 3 ppm

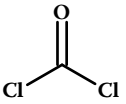
Final AEGLs
AEGL-1: 1 hr – 0.033 ppm; 4 hr – 0.033 ppm; 8 hr – 0.033 ppm
AEGL-2: 1 hr – 0.24 ppm; 4 hr – 0.13 ppm; 8 hr – 0.095 ppm
AEGL-3: 1 hr – 8.5 ppm; 4 hr – 4.5 ppm; 8 hr – 3.3 ppm

Properties:

MW: 159.8
D: 3.1 g/mL
MP: 19°F
BP: 139°F
Vsc: 0.38 cS (68°F)
VP: 172 mmHg
VD: 5.5
Vlt: 230,000 ppm
ER: 470
H_2O: 3.4% (77°F)
Sol: Common organic solvents
FlP: NA
LEL: NA
UEL: NA
RP: 0.05
IP: 10.55 eV

C10-A003

Phosgene (Agent CG)
CAS: 75-44-5
RTECS: SY5600000
UN: 1076; 125
EC: 200-870-3
UNII: 117K140075
ICD-11: XM91W5



$C\ Cl_2\ O$

Colorless gas with an odor like new mown grass or green corn detectable at ≥1.5 ppm. At high concentration, the odor may be strong, stifling, and unpleasant. Eyes, nose, and throat become irritated at 3–4 ppm.

Also reported as a mixture with chlorine (C10-A001).

This material is on Schedule 3 of the CWC, DHS Chemicals of Interest list, Australia Chemicals of Security Concern list, ITF-25 High Threat list, and NRL High Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 4.04 mg/m^3 at 77°F

$LCt_{50\ (Inh)}$: 1,500 mg-min/m^3 (190 ppm for a 2-minute exposure).

Exposures to 2 ppm for 80 minutes will not cause irritation but will produce pulmonary edema in 12 to 16 hours.

Eye Irritation: 0.1 ppm; exposure duration unspecified
$MEG_{(1hr)}$: Neg: 0.099 ppm; Mar: 0.30 ppm; Crit: 0.74 ppm; Cat: —
PAC-1: 0.027 ppm; *PAC-2:* 0.30 ppm; *PAC-3:* 0.74 ppm
PEL: 0.1 ppm
REL: 0.1 ppm
TLV: 0.1 ppm
$Ceiling_{(NIOSH)}$: 0.2 ppm
IDLH: 2.0 ppm

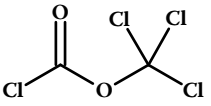
Final AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 0.30 ppm; 4 hr – 0.080 ppm; 8 hr – 0.040 ppm
AEGL-3: 1 hr – 0.75 ppm; 4 hr – 0.20 ppm; 8 hr – 0.090 ppm

Properties:

MW: 98.9	*VP:* 1,173 mmHg	*FlP:* NA
D: 1.4 g/mL (liq. gas, 77°F)	*VD:* 3.4	*LEL:* NA
MP: –198°F	*Vlt:* NA	*UEL*: NA
BP: 46°F	*ER:* 330	*RP:* NA
Vsc: 0.28 cS (liq. gas, 77°F)	*H_2O:* Very slight (decomposes)	*IP:* 11.55 eV
	Sol: Most organic solvents	

C10-A004

Diphosgene (Agent DP)
CAS: 503-38-8
RTECS: LQ7350000
UN: 1076; 125
EC: 207-965-9
UNII: PO4Q4R80LV
ICD-11: —



$C_2\ Cl_4\ O_2$

Colorless liquid with an odor like new mown grass or green corn detectable at ≥0.5 ppm.

Decomposes in contact with porous materials, including activated charcoal, or when heated above 572°F to produce two molecules of phosgene (C10-A003). Moisture may accelerate decomposition to phosgene at normal temperatures.

Exposure Hazards

Conversion Factor: 1 ppm = 8.09 mg/m^3 at 77°F

$LCt_{50\ (Inh)}$: 1,500 mg-min/m^3 (93 ppm for a 2-minute exposure)

This is a provisional update from an older value that has not been formally adopted. See phosgene (C10-A003) for additional exposure hazards.

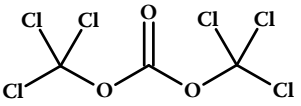
Properties:

MW: 197.8	*VP:* 4.2 mmHg	*FlP:* NA
D: 1.7 g/mL	*VD:* 6.8	*LEL:* NA
MP: –71°F	*Vlt:* 1,500 ppm	*UEL*: NA
BP: 261°F	*H_2O:* Insoluble	*RP:* 1.7
Vsc: —	*Sol:* Most organic solvents	*IP:* —

C10-A005

Triphosgene

CAS: 32315-10-9
RTECS: —
UN: —
EC: 250-986-3
UNII: 2C0677Q3B2
ICD-11: —



C2 Cl4 O2

White to off-white crystalline material that is odorless.

Pure triphosgene decomposes when heated above 266°F to produce three molecules of phosgene (C10-A003). Impure material decomposes at lower temperatures. Moisture may accelerate decomposition to phosgene at normal temperatures.

Exposure Hazards

Conversion Factor: 1 ppm = 12.14 mg/m^3 at 77°F

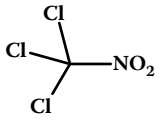
Human toxicity values have not been established or have not been published. See Phosgene (C10-A003) for additional exposure hazards.

Properties:

MW: 296.7	*VP:* —	*FlP:* —
D: 1.8 g/cm^3	*VD:* —	*LEL:* —
MP: 174°F	*Vlt:* —	*UEL:* —
BP: 397°F	*H_2O:* Insoluble (decomposes slowly)	*RP:* —
Vsc: —	*Sol:* Ether, ethanol, hexane	*IP:* —

C10-A006

Chloropicrin (Agent PS)
CAS: 76-06-2
RTECS: PB6300000
UN: 1580; 154
EC: 200-930-9
UNII: I4JTX7Z7U2
ICD-11: XM3U53



C Cl3 N O2

Colorless to faint yellow oily liquid with a stinging, pungent, intensely irritating odor that is detectable at ≥1.1 ppm. Concentrations between 0.3 and 1.35 ppm cause painful eye irritation in less than 30 seconds. Contact with the liquid produces skin lesions.

Decomposes on exposure to light. Large volumes of this chemical may be shock sensitive. When heated, this compound may decompose violently.

Also reported as a military mixture with chlorine (C10-A001); chloroacetophenone (C13-A008); diphosgene (C10-A004); ethyl iodoacetate (C13-A012); hydrogen sulfide (C07-A006); phosgene (C10-A003); stannic chloride; sulfuryl chloride (C11-A158); and commercially with methyl bromide (C11-A110).

This material is on Schedule 3 of the CWC, DHS Chemicals of Interest list, and Australia Chemicals of Security Concern list.

Exposure Hazards

Conversion Factor: 1 ppm = 6.72 mg/m^3 at 77°F
$LCt_{50\ (Inh)}$: 2,000 mg-min/m^3 (149 ppm for a 2-minute exposure)
Eye Irritation: 0.3 ppm for a 30-second exposure
Lacrimation: 1–3 ppm; exposure duration unspecified
Intolerable Irritation: 15 ppm for a 1-minute exposure
$MEG_{(1hr)}$: Neg: 0.050 ppm; Mar: 0.15 ppm; Crit: 1.4 ppm; Cat: —
PAC-1: 0.051 ppm; *PAC-2:* 0.15 ppm; *PAC-3:* 1.4 ppm
PEL: 0.1 ppm
REL: 0.1 ppm
TLV: 0.1 ppm
IDLH: 2 ppm

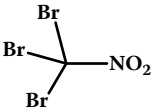
Interim AEGLs
AEGL-1: 1 hr – 0.050 ppm; 4 hr – 0.050 ppm; 8 hr – 0.050 ppm
AEGL-2: 1 hr – 0.15 ppm; 4 hr – 0.15 ppm; 8 hr – 0.15 ppm
AEGL-3: 1 hr – 1.4 ppm; 4 hr – 0.79 ppm; 8 hr – 0.58 ppm

Properties:

MW: 164.4	*VP:* 18.3 mmHg	*FlP:* NA
D: 1.7 g/mL	*VD:* 5.6	*LEL:* NA
MP: –93°F	*Vlt:* 25,000 ppm	*UEL*: NA
BP: 234°F	*ER:* —	*RP:* 0.42
Vsc: —	H_2O: 0.19%	*IP:* —
	Sol: Most organic solvents	

C10-A007

Bromopicrin
CAS: 464-10-8
RTECS: PB0100000
UN: —
EC: 207-348-4
UNII: 3412AKG60Q
ICD-11: —



C Br_3 N O_2

Prismatic crystals or oily, colorless liquid.

Exposure Hazards
Conversion Factor: 1 ppm = 12.18 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

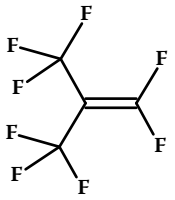
Properties:

MW: 297.7	*VP:* 2.96 mmHg (77°F)	*FlP:* —
D: 2.8 g/mL	*VD:* 10	*LEL:* —
MP: 50°F	*Vlt:* 3,900 ppm (77°F)	*UEL*: —
BP: 192°F	H_2O: <0.1% (64°F)	*RP:* 2.0
Vsc: —	*Sol:* —	*IP:* —

C10-A008

Perfluoroisobutylene (PFIB)
CAS: 382-21-8
RTECS: UD1800000
UN: —
EC: —

UNII: 1J9BGS6NTY
ICD-11: —



$C_4 F_8$

Colorless, odorless gas. Produced by decomposition of Teflon when heated above 887°F.

This material is on Schedule 2 of the CWC and the DHS Chemicals of Interest list.

Used to produce other chemicals and in making semiconductors.

A few hours after exposure, there is a gradual increase in temperature (up to 104°F), pulse rate (up to 120 bpm) and sometimes in respiration rate. There is no known post-exposure medical or chemical treatment that slows or reverses the effects of PFIB.

Exposure Hazards

Conversion Factor: 1 ppm = 8.18 mg/m^3 at 77°F

Lethal human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be approximately ten time more toxic than phosgene (C10-A003).

MEG$_{(1hr)}$: Neg: 0.012 ppm; Mar: 0.11 ppm; Crit: 0.33 ppm; Cat: —
PAC-1: 0.010 ppm; *PAC-2:* 0.11 ppm; *PAC-3:* 0.33 ppm
Ceiling$_{(ACGIH)}$: 0.01 ppm

Interim AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 0.11 ppm; 4 hr – 0.028 ppm; 8 hr – 0.014 ppm
AEGL-3: 1 hr – 0.33 ppm; 4 hr – 0.083 ppm; 8 hr – 0.042 ppm

Properties:

MW: 200.0	*VP:* 1,740 mmHg (77°F)	*FlP:* —
D: 1.6 g/mL (32°F)	*VD:* 6.9	*LEL:* —
MP: –202°F	*Vlt:* —	*UEL*: —
BP: 45°F	*ER:* 180	*RP:* —
Vsc: —	*H_2O:* Insoluble	*IP:* 10.70 eV
	Sol: —	

C10-A009

Methyl Chlorosulfonate (C-Stoff)
CAS: 812-01-1
RTECS: —
UN: —
EC: 212-380-7
UNII: —
ICD-11: —

CH_3SO_3Cl

Clear, colorless to pale yellow viscous liquid. Vapors are highly irritating to the eyes and respiratory system. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts.

Also reported as a mixture with dimethyl sulfate (C03-A009).

Exposure Hazards

Conversion Factor: 1 ppm = 5.34 mg/m^3 at 77°F
$LC_{50\ (Inh)}$: 2,000 mg/m^3 (375 ppm) for a 10-minute exposure
Eye Irritation: 1.3 ppm; exposure duration unspecified

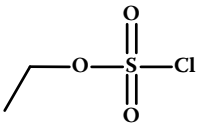
These values are from older sources (circa 1937) and are not supported by modern data. No updated toxicity estimates have been proposed.

Properties:

MW: 130.6	*VP:* 8.4 mmHg	*FlP:* —
D: 1.5 g/mL	*VD:* 4.5	*LEL:* —
MP: –94°F	*Vlt:* 11,000 ppm	*UEL*: —
BP: 232°F	*H_2O:* Reacts	*RP:* 1.0
Vsc: —	*Sol:* Chloroform, carbon tetrachloride	*IP:* —

C10-A010

Ethyl Chlorosulfonate (Sulvinite)
CAS: 625-01-4
RTECS: —
UN: —
EC: 210-874-7
UNII: —
ICD-11: —



$C_2\ H_5\ Cl\ O_3\ S$

Colorless, oily liquid with a pungent odor that fumes in moist air. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts.

Exposure Hazards

Conversion Factor: 1 ppm = 5.91 mg/m^3 at 77°F
$LC_{50\ (Inh)}$: 1,000 mg /m^3 (170 ppm); exposure duration unspecified
Eye Irritation: 1 ppm; exposure duration unspecified

These values are from older sources (circa 1937) and are not supported by modern data. No updated toxicity estimates have been proposed.

Properties:

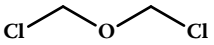
MW: 144.6	*VP:* 2.3 mmHg	*FlP:* —
D: 1.4 g/mL	*VD:* 5.0	*LEL:* —
MP: —	*Vlt:* 3,000 ppm	*UEL*: —

BP: 306°F	*H_2O:* Reacts	*RP:* 3.6
Vsc: —	*Sol:* Ether, chloroform	*IP:* —

C10-A011

Bis(chloromethyl) Ether

CAS: 542-88-1
RTECS: KN1575000
UN: 2249; 131
EC: 208-832-8
UNII: 77382IHE37
ICD-11: —



C_2 H_4 Cl_2 O

Colorless liquid with a strong, unpleasant and suffocating odor. This material is hazardous through inhalation, skin absorption, and ingestion, and produces local skin/eye impacts.

Reacts with moisture in the air to form formaldehyde (C11-A083) and hydrogen chloride (C11-A088).

Also reported as a mixture with ethyldibromoarsine; ethyldichloroarsine (C04-A001); sulfur mustard (C03-A001).

This material is the DHS Chemicals of Interest list

Exposure Hazards

Conversion Factor: 1 ppm = 4.70 mg/m^3 at 77°F

Effects the equilibrium. Casualties stagger and are unable to maintain balance.

$LCt_{50\ (Inh)}$: 4,700 mg-min/m^3 (500 ppm for a 2-minute exposure)
Respiratory/Eye Irritation: 3 ppm; exposure duration unspecified
Intolerable Irritation: 8.5 ppm; exposure duration unspecified

These values are from older sources (circa 1937) and are not supported by modern data. No updated toxicity estimates have been proposed.

$MEG_{(1hr)}$: Neg: 0.0060 ppm; Mar: 0.045 ppm; Crit: 0.18 ppm; Cat: —
PAC-1: 0.0040 ppm; *PAC-2:* 0.045 ppm; *PAC-3:* 0.18 ppm
TLV: 0.001 ppm

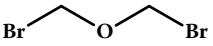
Final AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 0.044 ppm; 4 hr – 0.028 ppm; 8 hr – 0.020 ppm
AEGL-3: 1 hr – 0.18 ppm; 4 hr – 0.11 ppm; 8 hr – 0.075 ppm

Properties:

MW: 115.0	*VP:* 29.4 mmHg (77°F)	*FlP:* 66°F
D: 1.3 g/mL	*VD:* 4.0	*LEL:* —
MP: –43°F	*Vlt:* 40,000 ppm	*UEL*: —
BP: 219°F	*H_2O:* 2.2% (decomposes)	*RP:* 0.3
Vsc: —	*Sol:* Most organic solvents	*IP:* —

C10-A012

Bis(bromomethyl) Ether
CAS: 4497-29-4
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



C_2 H_4 Br_2 O

Colorless to yellow liquid. This material is hazardous through inhalation, skin absorption, and ingestion, and produces local skin/eye impacts.

Reacts with moisture in the air to form formaldehyde (C11-A083) and hydrogen bromide (C11-A087).

Also reported as a mixture with ethyldichloroarsine (C04-A001).

Exposure Hazards
Conversion Factor: 1 ppm = 8.34 mg/m^3 at 77°F

Effects the equilibrium. Casualties stagger and are unable to maintain balance.

$LCt_{50\ (Inh)}$: 4,000 mg-min/m^3 (240 ppm for a 2-minute exposure)
Respiratory/Eye Irritation: 2.4 ppm; exposure duration unspecified
Intolerable Irritation: 6.0 ppm; exposure duration unspecified

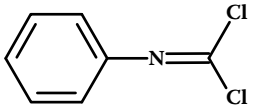
These values are from older sources (circa 1937) and are not supported by modern data. No updated toxicity estimates have been proposed.

Properties:

MW: 203.9	*VP:* 1.9 mmHg	*FlP:* —
D: 2.2 g/mL	*VD:* 7.0	*LEL:* —
MP: –29°F	*Vlt:* 2,500 ppm	*UEL*: —
BP: 311°F	*H_2O:* Insoluble	*RP:* 3.7
Vsc: —	*Sol:* Ether, benzene, acetone	*IP:* —

C10-A013

Phenylcarbylamine Chloride (K-Stoff)
CAS: 622-44-6
RTECS: NJ6700000
UN: 1672; 151
EC: 210-735-0
UNII: 84XDL272K2
ICD-11: —



$C_7 H_5 Cl_2 N$

Pale yellow, oily liquid with an odor like onions. This material is hazardous through inhalation, skin absorption, and ingestion, and produces local skin/eye impacts.

Exposure Hazards

Conversion Factor: 1 ppm = 7.12 mg/m^3 at 77°F
$LCt_{50\ (Inh)}$: 5,000 mg-min/m^3 (350 ppm for a 2-minute exposure)
Eye Irritation: 0.42 ppm; exposure duration unspecified
Intolerable Irritation: 3.5 ppm for a 1-minute exposure

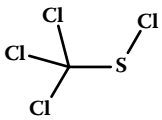
These values are from older sources (circa 1937) and are not supported by modern data. No updated toxicity estimates have been proposed.

Properties:

MW: 174.0	*VP:* 0.178 mmHg (77°F)	*FlP:* 174°F
D: 1.3 g/mL	*VD:* 6.0	*LEL:* —
MP: 67°F	*Vlt:* 295 ppm	*UEL*: —
BP: 410°F	*H_2O:* 0.04% (77°F)	*RP:* 43
Vsc: —	*Sol:* Alcohols, ether, chloroform	*IP:* —

C10-A014

Perchloromethyl Mercaptan (Clairsite)
CAS: 594-42-3
RTECS: PB0370000
UN: 1670; 157
EC: 209-840-4
UNII: KK489OII9M
ICD-11: —



$C Cl_4 S$

Pale yellow to red oily liquid with a foul, unbearable, acrid odor that is detectable at ≥0.016 ppm. This material is hazardous through inhalation, skin absorption, and ingestion, and produces local skin/eye impacts.

This material is on the DHS Chemicals of Interest list.

Also reported as a mixture with sulfur dichloride (C03-C039).

Used to produce dyes and fungicides.

Exposure Hazards

Conversion Factor: 1 ppm = 7.60 mg/m^3 at 77°F
$LCt_{50\ (Inh)}$: 30,000 mg-min/m^3 (2,000 ppm for a 2-minute exposure)
Eye Irritation: 1.3 ppm for a 2-minute exposure

Intolerable Irritation: 9.2 ppm; exposure duration unspecified

These values are from older sources (circa 1937) and are not supported by modern data. No updated toxicity estimates have been proposed.

$MEG_{(1hr)}$: Neg: 0.013 ppm; Mar: 0.30 ppm; Crit: 0.89 ppm; Cat: —
PAC-1: 0.013 ppm; *PAC-2:* 0.30 ppm; *PAC-3:* 0.89 ppm
PEL: 0.1 ppm
REL: 0.1 ppm
TLV: 0.1 ppm
IDLH: 10 ppm

Final AEGLs
AEGL-1: 1 hr – 0.013 ppm; 4 hr – 0.013 ppm; 8 hr – 0.013 ppm
AEGL-2: 1 hr – 0.30 ppm; 4 hr – 0.077 ppm; 8 hr – 0.037 ppm
AEGL-3: 1 hr – 0.90 ppm; 4 hr – 0.23 ppm; 8 hr – 0.11 ppm

Properties:

MW: 185.9	*VP:* 3 mmHg	*FlP:* NA
D: 1.7 g/mL	*VD:* 6.5	*LEL:* NA
MP: –47°F	*Vlt:* 2,400 ppm	*UEL*: NA
BP: 297°F (decomposes)	*ER:* —	*RP:* 2.4
Vsc: —	*H_2O:* Insoluble	*IP:* —
	Sol: Ether	

C10-A015

Chlorine Trifluoride (N-Stoff)
CAS: 7790-91-2
RTECS: FO2800000
UN: 1749; 124
EC: 232-230-4
UNII: 921841L3N0
ICD-11: —

ClF_3

Greenish-yellow fuming liquid or colorless gas with a sweet, irritating, and suffocating odor. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts.

Spontneously ignites in contact with organic or silicacious matter. Reacts with moist air to produce chlorine (C10-A001), hydrogen fluoride (C11-A089), and chlorine dioxide (C11-A038).

This material is the DHS Chemicals of Interest list, ITF-25 Low Threat list, and NRL Critical list.

Exposure Hazards

Conversion Factor: 1 ppm = 3.78 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.12 ppm; Mar: 2.0 ppm; Crit: 21 ppm; Cat: —
PAC-1: 0.12 ppm; *PAC-2:* 2.0 ppm; *PAC-3:* 21 ppm
$Ceiling_{(OSHA)}$: 0.1 ppm
$Ceiling_{(ACGIH)}$: 0.1 ppm
$Ceiling_{(NIOSH)}$: 0.1 ppm
IDLH: 20 ppm

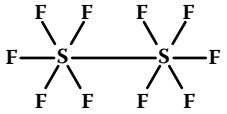
Final AEGLs
AEGL-1: 1 hr – 0.12 ppm; 4 hr – 0.12 ppm; 8 hr – 0.12 ppm
AEGL-2: 1 hr – 2.0 ppm; 4 hr – 0.7 ppm; 8 hr – 0.41 ppm
AEGL-3: 1 hr – 21 ppm; 4 hr – 7.3 ppm; 8 hr – 7.3 ppm

Properties:

MW: 92.4	*VP:* 1,060 mmHg	*FlP:* NA
D: 1.8 g/mL (liq. gas, 77°F)	*VD:* 3.2	*LEL:* NA
MP: –107°F	*Vlt:* —	*UEL*: NA
BP: 53°F	*ER:* 480	*RP:* NA
Vsc: 0.23 cS (77°F)	H_2O*:* Reacts	*IP:* 12.65 eV
	Sol: Carbon tetrachloride	

C10-A016

Disulfur Decafluoride (Agent Z)
CAS: 5714-22-7
RTECS: WS4480000
UN: —
EC: 227-204-4
UNII: 5XG19I842O
ICD-11: —



S_2F_{10}

Colorless liquid or gas that is odorless. Sulfur dioxide is a common impurity that will give the material that characteristic odor. This material is hazardous through inhalation and ingestion.

Exposure Hazards
Conversion Factor: 1 ppm = 10.39 mg/m^3 at 77°F
$MEG_{(1hr)}$*:* Neg: —; Mar: 0.0096 ppm; Crit: 0.96 ppm; Cat: —
PAC-1: 0.00088 ppm; *PAC-2:* 0.0096 ppm; *PAC-3:* 0.96 ppm
PEL: 0.025 ppm
$Ceiling_{(ACGIH)}$: 0.001 ppm
$Ceiling_{(NIOSH)}$: 0.01 ppm
IDLH: 1.0 ppm

Properties:

MW: 254.1	*VP:* 561 mmHg	*FlP:* NA
D: 2.1 g/mL (32°F)	*VD:* 8.8	*LEL:* NA
MP: –134°F	*Vlt:* 750,000 ppm	*UEL*: NA
BP: 84°F	*ER*: 180	*RP:* 0.01
Vsc: —	H_2O*:* Insoluble	*IP:* —
	Sol: —	

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11 Toxic Industrial Agents

GENERAL INFORMATION

Chemicals in this class include agricultural and industrial chemicals that are readily available and possess appropriate chemical and toxicological properties to create a mass impact if deliberately released. These materials appear on various threat lists including: the Chemical Weapons Convention (CWC); Australia Group's Core, Waring and Awareness lists; U.S. Select Agents and Toxins list; U.S. Department of Homeland Security (DHS) Chemicals of Interest list; Australia Chemicals of Security Concern list; U.S. Federal Burau of Investigation's (FBI) Highly Toxic Pesticides likely to be used by terrorists or for malicious intent list; the International Task Force 25's (ITF-25) High, Medium and Low lists; and the U.S. Naval Research Laboratory's (NRL) Critical and High lists. For more information on these compilations of threat materials, see appendix 4 in volume 2.

Factors considered when selecting potential candidate chemicals included physical state of the material (i.e., gas, liquid or solid), potential exposure pathways, chemicals likely to cause major morbidity or mortality, potential to cause public panic and social disruption, chemicals that require special action for public health preparedness, global production, history of previous use by the military and/or involvement in a significant industrial accident. The ITF-25 and NRL were particularly focused on agricultural and commercial industrial chemicals that could be significant during a military operation. These lists also include a number of materials with an elevated risk from flammability, reactivity (e.g., oxidizers, corrosives), or instability (e.g., explosives), but these materials are not included in this volume.

In addition to the chemicals included on these lists, various agencies have expressed concern about materials such as heavy metals (e.g., arsenic, lead, mercury), volatile solvents (e.g., benzene), decomposition products (e.g., dioxins, furans), carcinogens, and environmentally hazardous/bioaccumulative materials (e.g., polychlorinated biphenyls (PCBs)). Materials included in this volume are limited to those that are most likely to pose an acute toxicity hazard.

TOXICOLOGY

Effects

Many of these chemicals are similar to, but generally less toxic than, military chemical agents identified in other chapters of this book (e.g., nerve agents, vesicant agents, etc.). However, some of them are systemic poisons that act in ways that do not fit into one of the standard military classifications.

Pathways and Routes of Exposure

All of these materials pose some level of inhalation hazard. In addition, many are hazardous through ingestion or when introduced through broken, abraded or lacerated skin (e.g., penetration of skin by debris). Some of these materials readily pass through the skin to induce systemic intoxication. Some materials may also cause irritation to the skin and eyes.

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PROTECTION

Evacuation Recommendations

Traditional isolation and protective action distances for most of these materials can be found in the Department of Transportation 2020 Emergency Response Guidebook. These recommendations are based upon an accidental release during transportation of the material and involving a small spill (i.e., a commercial gas cylinder or 208 liters or less of liquid material), or a large spill (i.e., more than one gas cylinder, a large gas container such as a railcar, or more than 208 liters of liquid material). In the event of terrorism, sabotage, or a catastrophic release of these materials, the Guidebook recommends doubling these distances.

A simplified downwind hazard assessment can be developed by plotting these protective action distances in the form of a map overlay. The Initial Isolation Zone is the radius of a circle immediately surrounding the point of release where people may potentially be exposed to dangerous or life-threatening concentrations of vapor. The Protective Action Zone is the downwind area of potential threat posed by vapors carried by the wind. These distances were not developed to account for additional contamination from a dispersal device. In such cases, the initial isolation and downwind evacuation distances should begin at the edge of any contamination caused by the release. Figure 11.1 is an example of a simplified downwind hazard assessment for an irregular release that should be used during a deliberate release scenario causing significant localized contamination.

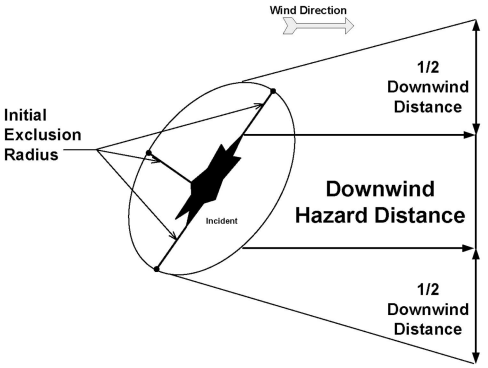


FIGURE 11.1 Irregular release simplified downwind hazard diagram.

The amount of contamination and the distance an agent cloud will travel is based primarily on the physical/chemical properties of the specific agent, method of release, local terrain and weather conditions. For more information on methods of dispersal, see appendix 1 in volume 2.

Personal Protective Requirements

Structural Firefighters' Gear

Structural firefighters' protective clothing is recommended for fire situations only; it is not effective in spill situations or release events. If chemical protective clothing is not available and it is necessary to rescue casualties from a contaminated area, then structural firefighters' gear will provide limited skin protection against agent vapors and aerosols. Contact with solid and liquid agents should be avoided. Depending on the material, firefighters who enter a contaminated area wearing only structural firefighters' gear may experience mild to moderate effects. Some materials, such as organophosphate pesticides, can accumulate in the body and responders who enter the hot zone without appropriate chemical protective clothing may be at increased risk during the remainder of the emergency.

Respiratory Protection

National Institute for Occupational Safety and Health (NIOSH) approved self-contained breathing apparatuses (SCBAs) or air purifying respirators (APRs) that have been tested by the manufacturer against the individual chemicals. APRs should be equipped with a NIOSH-approved Chemical/Biological/Radiological/Nuclear (CBRN) filter or a combination organic vapor/acid gas/particulate cartridge. Ensure the cartridge has been tested against the specific chemical and that the concentration of the agent does not exceed the saturation level of the cartridge. Air purifying respirators (APRs) are not recommended for use in atmospheres containing some of these chemicals because of poor warning properties of the agent and a short life span of respirator cartridges.

Immediately Dangerous to Life or Health (IDLH) levels are the ceiling limit for respirators other than SCBAs. Any exposures approaching the IDLH level should be regarded with extreme caution and the use of SCBAs for respiratory protection should be considered.

Chemical Protective Clothing

Use only chemical protective clothing that has undergone appropriate material and construction performance testing. If the concentration of vapor exceeds the level necessary to produce effects through dermal exposure, then responders should wear a Level A protective ensemble. Reported permeation rates may be affected by solvents if solutions of agents have been released.

Decontamination

General

Apply universal decontamination procedures using soap and water.

Vapors

Casualties/personnel

Remove all clothing as it may continue to emit trapped agent vapor after contact with the vapor cloud has ceased. Shower using copious amounts of soap and water. Ideally, showers will be high-volume with low-pressure. Ensure that the hair has been washed and rinsed to remove potentially trapped vapor. If eye irritation occurs, irrigate with water or 0.9% saline solution for a minimum of 15 minutes.

Small areas

Ventilate to remove the vapors. If deemed necessary, wash the area with copious amounts of soap and water. Collect and place into containers lined with high-density polyethylene. Removal of porous material, including painted surfaces, may be required because agents that has been absorbed into these materials may migrate back to the surface and pose a contact hazard.

Liquids, Solutions or Liquid Aerosols

Casualties/personnel

Cover all open wounds during the decontamination process. Remove all clothing immediately. Even clothing that has not come into direct contact with the agent may contain trapped vapor. To avoid further exposure of the head, neck and face to the agent, cut off potentially contaminated clothing that must be pulled over the head. Use a sponge or cloth with liquid soap and copious amounts of water to wash the skin surface and hair at least three times. Ideally, showers will be high volume with low pressure. Avoid rough scrubbing. Rinse with copious amounts of water. If water is not immediately available, the agent can be absorbed with any convenient material such as paper towels, toilet paper, flour or talc. To minimize both spreading the agent and abrading the skin, do not rub the agent with the absorbent. Blot the contaminated skin with the absorbent. If there is a potential that the eyes have been exposed, irrigate with water or 0.9% saline solution for a minimum of 15 minutes.

Small areas

Ventilate to remove the aerosol. Small puddles of liquid can be contained by covering with absorbent material such as vermiculite, diatomaceous earth, clay, sponges or towels. Place the absorbed material into containers lined with high-density polyethylene. Larger puddles can be collected using vacuum equipment made of materials inert to the released material and equipped with a high-efficiency particulate air (HEPA) filter and appropriate vapor filters. If there is a potential for corrosive residue, the area should be treated with an appropriate neutralizing agent. Wash the area with copious amounts of the soap and water. Collect and containerize the rinseate. Ventilate the area to remove residual vapors.

Solids or Particulate Aerosols

Casualties/personnel

Do not attempt to brush the agent off of the individual or their clothing as this can aerosolized the agent. Cover all open wounds during the decontamination process. If the material is not water reactive and it does not hamper the operation, dampen the agent with a water mist to help prevent aerosolization. Remove all clothing immediately. To avoid further exposure of the head, neck and face to the agent, cut off potentially contaminated clothing that must be pulled over the head. Wash the skin surface and hair at least three times with copious amounts of soap and water. Ideally, showers will be high volume with low pressure. Do not delay decontamination to find warm or hot water if it is not readily available. Rinse with copious amounts of water. If there is a potential that the eyes have been exposed, irrigate with water or 0.9% saline solution for a minimum of 15 minutes.

Small areas

If indoors, close windows and doors in the area and turn off anything that could create air currents (e.g., fans, air conditioner, etc.). Allow aerosol to settle. Avoid actions that could aerosolize the agent such as sweeping or brushing. Collected the agent with a vacuum cleaner made of materials inert to the released material and equipped with a high-efficiency particulate air (HEPA) filter and appropriate vapor filters. Do not use a standard home or industrial vacuum. Do not allow the vacuum exhaust to stir the air in the affected area. Vacuum all surfaces with extreme care in a very slow and controlled manner to minimize aerosolizing the agent. Place the collected material into containers lined with high-density polyethylene. If there is a potential for corrosive residue, the area should be treated with an appropriate neutralizing agent. Wash the area with copious amounts of the soap and water. Collect and containerize the rinseate in containers lined with high-density polyethylene. Ventilate the area to remove any agent vapors generated during the decontamination.

MEDICAL

CDC Case Definition

Case definitions have been established for various listed agents and are available in the following publications:

> Centers for Disease Control and Prevention. "Case Definitions for Chemical Poisoning." *Morbidity and Mortality Weekly* Volume 54 (RR-1) January 14, 2005

or online at:

> *Case Definitions for Chemical Poisoning.* April 4, 2018, [https://emergency.cdc.gov/chemical/casedef.asp] December 31, 2020

Signs and Symptoms

Vapors/aerosols

Vary depending on the specific chemical involved, concentration of the cloud and length of exposure. Common symptoms of acute exposure (in no specific order) may include: dizziness, loss of coordination, disorientation, problems breathing (e.g., rapid breathing, chest tightness, shortness of breath), chest pains, heart palpitations, problems seeing (e.g., blurred vision, eye irritation, pinpointing or dilation of the pupils), heavy sweating, headache, ringing in the ears, nose or skin irritation, coughing, nausea, vomiting, convulsions and loss of consciousness. Exposure to low concentrations of chemical may not produce immediate effects.

Liquids/solids

Vary depending on the specific chemical involved, concentration of the agent and length of exposure. Common symptoms of acute exposure (in no specific order) may include: irritation and burning of the skin, eyes, mucous membrane and respiratory system. Contact may also result in chemical burns to the skin and eyes.

Mass-Casualty Triage Recommendations

The base station physician or regional poison control center should be consulted for advice on specific situations. However, in general, anyone who has been exposed should be transported to a medical facility for evaluation. Individuals who are asymptomatic and have not been directly exposed to the chemical can be discharged after their names, addresses and telephone numbers have been recorded. They should be told to seek medical care immediately if symptoms develop.

Casualty Management

Remove casualty to fresh air and decontaminate with soap and water. Provide oxygen for respiratory distress. If the casualty complains of eye irritation, irrigate the eyes with water or 0.9% saline solution for at least 15 minutes. Irrigate open wounds with water or 0.9% saline solution for at least 10 minutes.

Once the casualty has been decontaminated, medical personnel do not need to wear a chemical-protective mask.

Prior to administering antidotes or other drugs, ensure that the signs and symptoms (e.g., coma, seizures, etc.) are due to chemical exposure and not the result of head trauma or other physical or psychological injury.

Consider tracheal intubation in cases of respiratory compromise. Treat patients who have bronchospasm with aerosolized bronchodilators. Use these and all catecholamines with caution because of the enhanced risk of cardiac dysrhythmias after exposure to some chemicals. When bronchodilators are needed, the lowest effective dose should be given and cardiac rhythm should be monitored. After decontamination, patients who are comatose, hypotensive, have cardiac dysrhythmias or are having seizures should be treated according to established advanced life support (ALS) protocols.

Consult the base station physician or regional poison control center for chemical specific information.

FATALITY MANAGEMENT

Remove all clothing and personal effects and decontaminate with soap and water. While it may be possible to decontaminate durable items, it may be safer and more efficient to destroy non-durable items rather than attempt to decontaminate them. Items that will be retained for further processing

should be double sealed in impermeable containers, ensuring that the inner container is decontaminated before placing it in the outer one.

To remove agents on the outside of the body, wear appropriate respiratory and dermal protective clothing while washing the remains with soap and water. Pay particular attention to areas where agent may get trapped, such as hair, scalp, pubic areas, fingernails, folds of skin and wounds. If remains are heavily contaminated with residue, wash and rinse waste should be contained for proper disposal.

If organophosphorus pesticides are involved, then it may be necessary to wash the remains with a 2% sodium hypochlorite bleach solution (i.e., two liters of water for every liter of household bleach), ensuring the solution is introduced into the ears, nostrils, mouth and any wounds. This concentration of bleach will not affect remains but will neutralize organophosphorus pesticides. Higher concentrations of bleach can harm remains. The bleach solution should remain on the cadaver for a minimum of 15 minutes. Then wash with soap and water. Ensure that all the bleach solution is removed prior to embalming as it will react with embalming fluid. All wash and rinse waste must be contained for proper disposal. Screen the remains for agent vapors and residual liquid at the conclusion of the decontamination process.

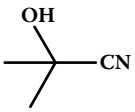
Once the remains have been thoroughly decontaminated, no further protective action is necessary. Body fluids removed during the embalming process do not pose any additional risks and should be contained and handled according to established procedures. Use standard burial procedures.

C11-A AGENTS

C11-A001

Acetone Cyanohydrin

CAS: 75-86-5
RTECS: OD9275000
UN: 1541; 155
EC: 200-909-4
UNII: CO1YOV1KFI
ICD-11: —



$C_4\ H_7\ N\ O$

Clear, colorless to light yellow liquid. Pure material is practically odorless but usually has an odor of bitter almond due to residual hydrogen cyanide. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Forms cyanide in the body. Effects include central nervous system depression with weakness (lassitude), confusion and convulsions; respiratory irritation with difficulty breathing (dyspnea), blue skin and lips (cyanosis), and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed.

Used industrially in organic synthesis, in the manufacture of insecticides and pharmaceuticals, as an intermediate in the synthesis of methacrylates; used as a complexing agent for metals refining and separation

This material is on the ITF-25 Medium Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 3.48 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 2.0 ppm; Mar: 7.2 ppm; Crit: 15 ppm; Cat: —
PAC-1: 2.0 ppm; *PAC-2:* 7.2 ppm; *PAC-3:* 15 ppm
$Ceiling_{(ACGIH)}$: 1.4 ppm [Skin] (as cyanide)
$Ceiling_{(NIOSH)}$: 1 ppm
WEEL: 2 ppm [Skin]
$STEL_{(OARS)}$: 5 ppm [Skin]

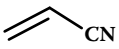
Final AEGLs
AEGL-1: 1 hr – 2.0 ppm; 4 hr – 1.3 ppm; 8 hr – 1.0 ppm
AEGL-2: 1 hr – 7.1 ppm; 4 hr – 3.5 ppm; 8 hr – 2.5 ppm
AEGL-3: 1 hr – 15 ppm; 4 hr – 8.6 ppm; 8 hr – 6.6 ppm

Properties:

MW: 85.1	*VP:* 0.75 mmHg	*FlP:* 165°F
D: 0.93 g/mL (77° F)	*VD:* 2.9	*LEL:* 2.2%
MP: –2°F	*Vlt:* 1,000 ppm	*UEL*: 12%
BP: 203°F	*ER:* —	*RP:* 14
Vsc: 5.16 cS	*H_2O:* Miscible	*IP:* 11.09 eV
	Sol: Most organic solvents	

C11-A002

Acrylonitrile
CAS: 107-13-1
RTECS: AT5250000
UN: 1093; 131P
EC: 203-466-5
UNII: MP1U0D42PE
ICD-11: XM23N0



$C_3\ H_3\ N$

Colorless to pale-yellow liquid with an odor that is pungent, irritating and resembles onions or garlic and detectable at ≥21.4 ppm. This material is hazardous through inhalation, skin absorption (liquid), penetration through broken skin, and ingestion, and produces local skin/eye impacts. Effects include central nervous system depression, difficulty breathing (dyspnea), blue skin and lips (cyanosis), and convulsions.

Used industrially for the manufacture of plastics, surface coatings, and adhesives; pharmaceuticals, dyes, ion exchange resins, corrosion inhibitors, water treatment resins; used agriculturally as a grain fumigant.

This material is on the ITF-25 Medium Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 2.17 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 10 ppm; Mar: 35 ppm; Crit: 74 ppm; Cat: —
PAC-1: 0.16 ppm; *PAC-2:* 1.7 ppm; *PAC-3:* 28 ppm

PEL: 2 ppm [Skin]
REL: 1 ppm [Skin]
TLV: 2 ppm [Skin]
Ceiling$_{(NIOSH)}$: 10 ppm [Skin]
IDLH: 60 ppm [Skin]

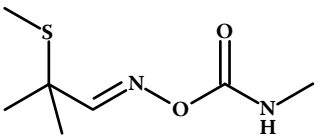
Properties:

MW: 53.1	*VP:* 83 mmHg	*FlP:* 30°F
D: 0.81 g/mL	*VD:* 1.8	*LEL:* 3.1%
MP: –116°F	*Vlt:* 120,000 ppm	*UEL*: 17%
BP: 171°F	*ER:* 370	*RP:* 0.16
Vsc: 0.043 cS (77°F)	*H_2O:* 7.5%	*IP:* 10.75 eV
	Sol: Alcohols, ethyl acetate, toluene	

C11-A003

Aldicarb

CAS: 116-06-3
RTECS: UE2275000
UN: —
EC: 204-123-2
UNII: 8V071SH05P
ICD-11: XM0HS9



$C_7\ H_{14}\ N_2\ O_2\ S$

Colorless to white crystalline material with a faint sulfur odor. This material is hazardous through inhalation, skin absorption, and ingestion, and produces local skin/eye impacts. It is a cholinesterase inhibitor.

Used industrially as a soil insecticide, acaricide, nematicide and avicide.

This material is on the FBI threat list, Australia Chemicals of Security Concern list, and NRL Critical Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 7.78 mg/m^3 at 77°F
MEG$_{(1hr)}$: Neg: 0.0003 mg/m^3; Mar: 0.087 mg/m^3; Crit: 0.26 mg/m^3; Cat: —
PAC-1: 0.027 mg/m^3; *PAC-2:* 0.3 mg/m^3; *PAC-3:* 1.8 mg/m^3
TLV: 0.005 mg/m^3 [Skin]
WEEL: 0.01 mg/m^3 [Skin]

Proposed AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 0.087 mg/m^3; 4 hr – 0.053 mg/m^3; 8 hr – 0.027 mg/m^3
AEGL-3: 1 hr – 0.26 mg/m^3; 4 hr – 0.16 mg/m^3; 8 hr – 0.081 mg/m^3

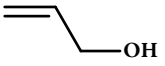
Properties:

MW: 190.3	*VP:* 9.8×10^{-5} mmHg	*FlP:* —
D: 1.2 g/cm^3 (77°F)	*VD:* 6.6	*LEL:* —
MP: 210°F	*Vlt:* —	*UEL*: —
BP: Decomposes	*ER:* —	*RP:* —
Vsc: —	*H_2O:* 0.49%	*IP:* —
	Sol: Acetone, ethanol	

C11-A004

Allyl Alcohol

CAS: 107-18-6
RTECS: BA5075000
UN: 1098; 131
EC: 203-470-7
UNII: 3W678R12M0
ICD-11: XM51N7



C_3 H_6 O

Mobile colorless liquid with a pungent odor like mustard detectable at ≥0.8 ppm. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Contact produces first- and second-degree burns with blisters (vesiculation), severe eye irritation. Absorbed material converts to acrolein in the body with acute cardiotoxicity. Liver toxicant that acts synergistically with alcohol in blood.

Used industrially for the manufacture of flavorings, perfumes, acrolein, diallyl phthalate, diallyl isophthalate, and pharmaceuticals; used to denature alcohol. Used agriculturally as an herbicide and fungicide.

This material is on the ITF-25 Medium Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 2.38 mg/m^3 at 77°F
Minor Eye Irritation: 5 ppm; exposure duration unspecified
Severe Eye Irritation: 25 ppm; exposure duration unspecified
Nasal Irritation: 10 ppm; exposure duration unspecified
$MEG_{(1hr)}$: Neg: 2.1 ppm; Mar: 4.2 ppm; Crit: 20 ppm; Cat: —
PAC-1: 0.088 ppm; *PAC-2:* 1.7 ppm; *PAC-3:* 13 ppm
PEL: 2 ppm [Skin]
REL: 2 ppm [Skin]
TLV: 0.5 ppm [Skin]
$STEL_{(NIOSH)}$: 4 ppm [Skin]
IDLH: 20 ppm [Skin]

Final AEGLs
AEGL-1: 1 hr – 0.09 ppm; 4 hr – 0.09 ppm; 8 hr – 0.09 ppm
AEGL-2: 1 hr – 1.7 ppm; 4 hr – 0.73 ppm; 8 hr – 0.33 ppm
AEGL-3: 1 hr – 13 ppm; 4 hr – 3.1 ppm; 8 hr – 1.5 ppm

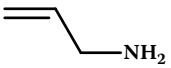
Properties:

MW: 58.1	*VP:* 17 mmHg	*FlP:* 70°F
D: 0.85 g/mL	*VP:* 26.1 mmHg (77°F)	*LEL:* 2.5%
MP: –200°F	*VD:* 2.0	*UEL*: 18.0%
BP: 207°F	*Vlt:* 24,000 ppm	*RP:* 0.77
Vsc: 1.3 cS (77°F)	*ER:* —	*IP:* 9.63 eV
	H_2O: Miscible	
	Sol: Alcohol, chloroform, ether	

C11-A005

Allylamine

CAS: 107-11-9
RTECS: BA5425000
UN: 2334; 131
EC: 203-463-9
UNII: 48G762T011
ICD-11: —



C_3 H_7 N

Colorless to yellow liquid with a strong, pungent ammonia odor. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Severe irritant causing irregular respiration with blue skin and lips (cyanosis); may induce seizures and coma.

Used industrially for synthesis of ion-exchange resins and pharmaceutical intermediates.

This material is on the ITF-25 Medium Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 2.34 mg/m^3 at 77°F
Irritation: 2.5 ppm; exposure duration unspecified
Intolerable Irritation: 14 ppm; exposure duration unspecified
MEG$_{(1hr)}$: Neg: 0.42 ppm; Mar: 3.3 ppm; Crit: 19 ppm; Cat: —
PAC-1: 0.42 ppm; *PAC-2:* 3.3 ppm; *PAC-3:* 18 ppm

Final AEGLs
AEGL-1: 1 hr – 0.42 ppm; 4 hr – 0.42 ppm; 8 hr – 0.42 ppm
AEGL-2: 1 hr – 3.3 ppm; 4 hr – 1.8 ppm; 8 hr – 1.2 ppm
AEGL-3: 1 hr – 18 ppm; 4 hr – 3.5 ppm; 8 hr – 2.3 ppm

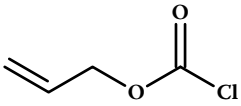
Properties:

MW: 57.1	*VP:* 193 mmHg	*FlP:* –18°F
D: 0.76 g/mL	*VD:* 2.0	*LEL:* 2.2%
MP: –126°F	*Vlt:* 260,000 ppm	*UEL*: 22%
BP: 127°F	*ER:* 320	*RP:* 0.06
Vsc: 0.58 cS (77°F)	H_2O: Miscible	*IP:* 8.8 eV
	Sol: Alcohol, chloroform, ether	

C11-A006

Allyl Chloroformate

CAS: 2937-50-0
RTECS: LQ5775000
UN: 1722; 155
EC: 220-916-6
UNII: 7672CAR559
ICD-11: —



$C_4\ H_5\ Cl\ O_2$

Colorless watery liquid with a pungent odor detectable at ≥1.4 ppm. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts. Contact produces first- and second-degree burns, severe eye irritation. Severe respiratory irritant with possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed.

Monomer used in the manufacture of some polycarbonate lenses; used as a chemical intermediate for numerous compounds.

This material is on the ITF-25 Medium Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 4.93 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.10 ppm; Mar: 0.71 ppm; Crit: 2.0 ppm; Cat: —
PAC-1: 0.063 ppm; *PAC-2:* 0.69 ppm; *PAC-3:* 2.0 ppm

Final AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 0.70 ppm; 4 hr – 0.18 ppm; 8 hr – 0.090 ppm
AEGL-3: 1 hr – 2.1 ppm; 4 hr – 0.53 ppm; 8 hr – 0.26 ppm

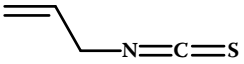
Properties:

MW: 120.5	*VP:* 20 mmHg (77°F)	*FlP:* 88°F
D: 1.1 g/mL	*VD:* 4.2	*LEL:* —
MP: –112°F	*Vlt:* 26,000 ppm	*UEL:* —
BP: 230°F	*ER:* —	*RP:* 0.46
Vsc: 0.62 cS	*H_2O:* Insoluble (decomposes)	*IP:* —
	Sol: —	

C11-A007

Allyl Isothiocyanate

CAS: 57-06-7
RTECS: NX8225000
UN: 1545; 155
EC: 200-309-2
UNII: BN34FX42G3
ICD-11: —



$C_4\ H_5\ N\ S$

Clear colorless to pale yellow oily liquid with an irritating, pungent odor like mustard that is detectable at ≥0.008 ppm. It tends to darken on storage. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Violent irritant; contact produces first- and second-degree burns, severe eye and respiratory irritation. It causes sensitization through both inhalation and skin contact.

Used industrially as a fumigant, fungicide, animal repellent, insect attractant; used in the preparation of medicinal ointments and mustard plasters; used as a flavoring agent, and denaturant for alcohol.

This material is on the ITF-25 Low Threat list.

Exposure Hazards

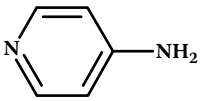
Conversion Factor: 1 ppm = 4.06 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 1.0 ppm; Mar: 2.5 ppm; Crit: 12 ppm; Cat: —
PAC-1: 1.0 ppm; *PAC-2:* 2.7 ppm; *PAC-3:* 17 ppm
$STEL_{(OARS)}$: 1 ppm [Skin]

Properties:	*VP:* 3.7 mmHg (86°F)	*FlP:* 115°F
MW: 99.2	*VD:* 3.4	*LEL:* —
D: 1.0 g/mL	*Vlt:* 4,800 ppm (86°F)	*UEL*: —
MP: –112°F	*ER:* —	*RP:* 2.8
BP: 306°F	*H_2O:* 0.2%	*IP:* —
Vsc: —	*Sol:* Most organic solvents	

C11-A008

4-Aminopyridine

CAS: 504-24-5; 1003-40-3 (Hydrochloride salt)
RTECS: US1750000
UN: 2671; 153
EC: 207-987-9
UNII: BH3B64OKL9
ICD-11: —



$C_5\ H_6\ N_2$

White to light brown crystalline material that is odorless. Various salts (solids) have been reported. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. It is a potent convulsant that also causes an abnormal burning, prickling, itching, or tingling skin sensation (paresthesia) and atrial fibrillation.

Used for medicinal purposes and industrially as an avicide.

Exposure Hazards

Conversion Factor: 1 ppm = 3.85 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 13 mg/m^3; Mar: —; Crit: 20 mg/m^3; Cat: —
PAC-1: 1.8 mg/m^3; *PAC-2:* 20 mg/m^3; *PAC-3:* 40 mg/m^3

Properties:

MW: 94.1	*VP:* 2.09×10^{-4} mmHg	*FlP:* 328°F
D: 1.3 g/mL	*VD:* 3.2	*LEL:* —
MP: 318°F	*Vlt:* —	*UEL*: —
BP: 524°F	*H_2O:* 8% (77°F)	*RP:* 49,000
Vsc: —	*Sol:* Ethyl ether, benzene, ethanol	*IP:* 8.77 eV

C11-A009

Ammonia, Anhydrous

CAS: 7664-41-7
RTECS: BO0875000
UN: 1005; 125
EC: 231-635-3
UNII: 5138Q19F1X
ICD-11: XN4TP4

NH_3

Colorless gas with a pungent, suffocating odor detectable at ≥47 ppm. Shipped as a liquefied compressed gas. This material is hazardous through inhalation and produces local skin/eye impacts. Causes severe skin, eye, and respiratory irritation with difficulty breathing (dyspnea) and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed.

Used in agriculture as a fertilizer, defoliant and grain fumigant; in the manufacture of nitric acid, hydrazine, hydrogen cyanide, urethanes, acrylonitrile, nitrocellulose, nitroparaffins, melamine, ethylene diamine, and sodium carbonate; as an intermediate in producing explosives, synthetic fibers and dyes; and used industrially as a refrigerant gas, neutralizing agent in the petroleum industry, latex preservative, and the production of fuel cells.

This material is on the Australia Chemicals of Security Concern list, ITF-25 High Threat list and NRL High Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 0.70 mg/m^3 at 77°F
$LC_{(Inh)}$: 7,100 mg /m^3 (5,000 ppm); short exposure
Eye Irritation: 698 ppm; immediate upon exposure
Respiratory Irritation: 408 ppm; exposure duration unspecified
Skin Burns: 2%–3% on wet skin
$MEG_{(1hr)}$: Neg: 30 ppm; Mar: 160 ppm; Crit: 1,100 ppm; Cat: —
PAC-1: 30 ppm; *PAC-2:* 160 ppm; *PAC-3:* 1,100 ppm
PEL: 50 ppm
REL: 25 ppm
TLV: 25 ppm
$STEL_{(ACGIH)}$: 35 ppm
$STEL_{(NIOSH)}$: 35 ppm
IDLH: 300 ppm

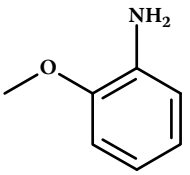
Final AEGLs
AEGL-1: 1 hr – 30 ppm; 4 hr – 30 ppm; 8 hr – 30 ppm
AEGL-2: 1 hr – 160 ppm; 4 hr – 110 ppm; 8 hr – 110 ppm
AEGL-3: 1 hr – 1,100 ppm; 4 hr – 550 ppm; 8 hr – 390 ppm

Properties:

MW: 17.0	*VP:* 6,500 mmHg	*FlP:* —
D: 0.60 g/mL (liq. gas, 77°F)	*VD:* 0.59	*LEL:* 15%
MP: –108°F	*Vlt:* NA	*UEL*: 28%
BP: –28°F	*ER:* 860	*RP:* NA
Vsc: 0.22 cS (liq. gas, 77°F)	*H_2O:* 34%	*IP:* 10.18 eV
	Sol: Alcohol, chloroform, ether	

C11-A010

o-Anisidine
CAS: 90-04-0; 134-29-2 (Hydrochloride salt)
RTECS: BZ5410000
UN: 2431; 153
EC: 201-963-1
UNII: NUX042F201
ICD-11: XM3R71



C_7 H_9 N O

Clear, colorless oily liquid that is light sensitive and becomes yellow, red, or brownish on exposure to air. It has an ammonia or fish-like odor. Various salts (solids) have been reported. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Causes headache and dizziness with blue skin and lips (cyanosis).

Used industrially as an intermediate in the manufacturing of dyes, pharmaceuticals, and fragrances.

This material is on the NRL Critical Threat list.

Exposure Hazards
Conversion Factor: 1 ppm = 5.04 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 1.5 mg/m^3; Mar: 2.5 mg/m^3; Crit: 50 mg/m^3; Cat: —
PAC-1: 1.5 mg/m^3; *PAC-2:* 8.3 mg/m^3; *PAC-3:* 50 mg/m^3
PEL: 0.5 mg/m^3 [Skin]
REL: 0.5 mg/m^3 [Skin]
TLV: 0.5 mg/m^3 [Skin]
IDLH: 50 mg/m^3 [Skin]

Properties:

MW: 123.2	*VP:* 0.080 mmHg	*FlP:* 244°F
D: 1.1 g/mL	*VD:* 4.3	*LEL:* —
MP: 41°F	*Vlt:* 1,500 ppm	*UEL*: —

BP: 437°F	*ER:* —	*RP:* 8.1
Vsc: 2.0 cS (131°F)	*H_2O:* 1.3% (77°F)	*IP:* 7.44 eV
	Sol: Miscible in ethanol, benzene, diethyl ether, acetone	

C11-A011

Arsenic Pentoxide
CAS: 1303-28-2
RTECS: CG2275000
UN: 1559; 151
EC: 215-116-9
UNII: 4GWL8T475I
ICD-11: —

As_2O_5
White crystalline, deliquescent solid. This material is hazardous through inhalation, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Contact produces a burning sensation with redness and pain. Inhalation causes headache, dizziness, and weakness (lassitude), with difficulty breathing (dyspnea). Symptoms may be delayed.

Used industrially in adhesives for metals, in the manufacture of colored glass, as an insecticide, wood preservative, fungicide and in weed control.

This material is on the Australia Chemicals of Security Concern list.

Exposure Hazards
Conversion Factor: NA
$MEG_{(1hr)}$: Neg: 1.0 mg/m^3; Mar: —; Crit: 7.7 mg/m^3; Cat: —
PAC-1: 0.73 mg/m^3; *PAC-2:* 8.0 mg/m^3; *PAC-3:* 150 mg/m^3
PEL: 0.010 mg/m^3 as arsenic
$Ceiling_{(NIOSH)}$: 0.002 mg/m^3 as arsenic
IDLH: 5 mg/m^3 as arsenic

Properties:

MW: 229.8	*VP:* —	*FlP:* NA
D: 4.3 g/cm^3	*VD:* —	*LEL:* NA
MP: 599°F	*Vlt:* —	*UEL*: NA
BP: Decomposes	*ER:* —	*RP:* —
Vsc: —	*H_2O:* 67%	*IP:* —
	Sol: Ethanol	

C11-A012

Arsenic Trioxide
CAS: 1327-53-3
RTECS: CG3325000
UN: 1561; 151
EC: 215-481-4
UNII: S7V92P67HO
ICD-11: XM2KQ2

As_2O_3

White to light grey crystalline solid that is odorless and tasteless. This material is hazardous through inhalation, and ingestion, and produces local skin/eye impacts. Contact produces a burning sensation with redness and pain. Inhalation causes headache, dizziness, and weakness (lassitude), with difficulty breathing (dyspnea). Symptoms may be delayed.

Used industrially as a rodenticide, raw material for glass and ceramic production, and intermediate for preparation of other arsenical products.

Produces Arsine (C08-A001) and arsenic oxide fumes when burned.

This material is on the FBI threat lists, Australia Chemicals of Security Concern list, and NRL High Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 8.09 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.40 mg/m^3; Mar: 3.0 mg/m^3; Crit: 9.1 mg/m^3; Cat: —
PAC-1: 0.27 mg/m^3; *PAC-2:* 3.0 mg/m^3; *PAC-3:* 9.1 mg/m^3
PEL: 0.010 mg/m^3 as arsenic
TLV: 0.01 mg/m^3 as arsenic
$Ceiling_{(NIOSH)}$: 0.002 mg/m^3 as arsenic
IDLH: 5 mg/m^3 as arsenic

Interim AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 3.0 mg/m^3; 4 hr – 1.9 mg/m^3; 8 hr – 1.2 mg/m^3
AEGL-3: 1 hr – 9.1 mg/m^3; 4 hr – 5.7 mg/m^3; 8 hr – 3.7 mg/m^3

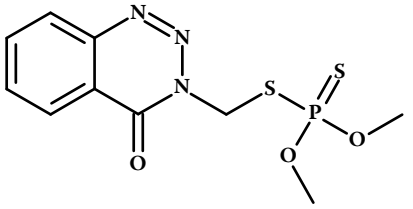
Properties:

MW: 197.8 (As_2O_3 claudetite)	*VP:* 2.5 × 10^{-4} mmHg (77°F)	*FlP:* NA
MW: 395.7 (As_4O_6 arsenolite)	*VD:* 6.8	*LEL:* NA
D: 3.9–4.2 g/cm^3	*Vlt:* —	*UEL*: NA
MP: 525°F (arsenolite)	*ER:* —	*RP:* 29,000
MP: 595°F (claudetite)	*H_2O:* 1.6% (61°F)	*IP:* —
BP: Sublimes	*Sol:* Glycerol	
Vsc: —		

C11-A013

Azinphos-Methyl

CAS: 86-50-0
RTECS: TE1925000
UN: 265842EWUV
EC: 201-676-1
UNII: —
ICD-11: XM7H46



$C_{10}\ H_{12}\ N_3\ O_3\ P\ S_2$

Colorless to white or yellow crystalline material that has no odor. Technical grade is a cream to amber granular or waxy solid. This material is hazardous through inhalation, skin absorption, and ingestion, and produces local skin/eye impacts. It is a cholinesterase inhibitor.

Used industrially as an insecticide, acaricide and molluscicide.

This material is on the FBI threat list, Australia Chemicals of Security Concern list, and NRL Critical Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 12.98 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.60 mg/m^3; Mar: 0.70 mg/m^3; Crit: 10 mg/m^3; Cat: —
PAC-1: 0.60 mg/m^3; *PAC-2:* 0.70 mg/m^3; *PAC-3:* 20 mg/m^3
PEL: 0.2 mg/m^3 [Skin]
REL: 0.2 mg/m^3 [Skin]
TLV: 0.2 ppm [Skin]
IDLH: 10 mg/m^3 [Skin]

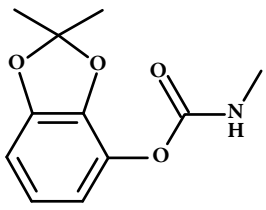
Properties:

MW: 317.3	*VP:* 2×10^{-7} mmHg	*FlP:* NA
D: 1.4 g/cm^3	*VD:* 11	*LEL:* NA
MP: 162°F	*Vlt:* —	*UEL*: NA
MP: 153°F (commercial grade)	*ER:* —	*RP:* —
BP: Decomposes	*H_2O:* 0.002%	*IP:* —
Vsc: —	*Sol:* Most organic solvents	

C11-A014

Bendiocarb

CAS: 22781-23-3
RTECS: FC1140000
UN: —
EC: 245-216-8
UNII: QFH0ZU0A5U
ICD-11: —



$C_{11}\ H_{13}\ N\ O_4$

White solid that is odorless. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts without irritation. It is a cholinesterase inhibitor.

Used as a contact insecticide.

Exposure Hazards

Conversion Factor: 1 ppm = 9.13 mg/m^3 at 77°F
TLV: 0.1 mg/m^3 [Skin]

Properties:

MW: 223.2	*VP:* 3.45 × 10^{-5} mmHg (77°F)	*FlP:* —
D: 1.3 g/cm^3	*VD:* 7.7	*LEL:* —
MP: 264°F	*Vlt:* —	*UEL*: —
BP: —	*ER:*	*RP:* —
Vsc: —	*H_2O:* 0.026% (77°F)	*IP:* —
	Sol: Alcohols, acetone, dichloromethane	

C11-A015

Beryllium Sulfate

CAS: 13510-49-1
RTECS: DS5000000
UN: —
EC: 236-842-2
UNII: 01UQ1KPC7E
ICD-11: —

$BeSO_4$

Colorless, crystalline, hygroscopic solid with no odor. This material is hazardous through inhalation. Causes respiratory irritation with possible inflammation of lung tissue (pneumonitis).

Primarily used to produce beryllium oxide powder used in the manufacture of high-technology ceramics.

This material is the Australia Chemicals of Security Concern list.

Exposure Hazards

Conversion Factor: NA
PEL: 0.0002 mg/m^3 as beryllium
$STEL_{(OSHA)}$: 0.002 mg/m^3 as beryllium
IDLH: 4 mg/m^3 as beryllium

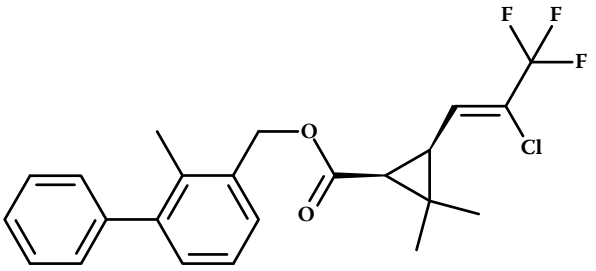
Properties:

MW: 105.1	*VP:* —	*FlP:* NA
D: 2.5 g/cm^3	*VD:* —	*LEL:* NA
MP: 2,061°F	*Vlt:* —	*UEL*: NA
BP: Decomposes	*ER:* —	*RP:* —
Vsc: —	*H_2O:* 41% (77°F)	*IP:* —
	Sol: —	

C11-A016

Bifenthrin

CAS: 82657-04-3
RTECS: GZ1227800
UN: —
EC: —
UNII: 6B66JED0KN
ICD-11: XM79U4



C_{23} H_{22} Cl F_3 O_2

Off-white to pale tan, waxy solid or light brown, viscous liquid with a faint, slightly sweet odor. Commercial products may be dark brown. This material is hazardous through inhalation, and ingestion, and produces local skin/eye impacts. Contact causes redness, pain, rash, blisters and sores. Inhalation causes respiratory irritation with difficulty breathing (dyspnea). It is a sensitizer. It is a third-generation synthetic pyrethroid used as an insecticide, acaricide, and miticide.

This material is on the NRL Critical Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 17.30 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

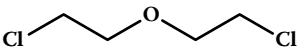
Properties:

MW: 422.9	*VP:* 1.34×10^{-8} mmHg	*FlP:* 329°F
D: 1.2 g/cm^3	*VD:* 15	*LEL:* —
MP: 156°F	*Vlt:* —	*UEL*: —
BP: —	*ER:* —	*RP:* —
Vsc: —	*H_2O:* Insoluble	*IP:* —
	Sol: Methylene chloride, acetone, ether, toluene	

C11-A017

Bis(2-chloroethyl) Ether

CAS: 111-44-4
RTECS: KN0875000
UN: 1916; 152
EC: 203-870-1
UNII: 6K7D1G5M5N
ICD-11: XM77V1



$C_4\ H_8\ Cl_2\ O$

Colorless clear liquid with a pungent odor. This material is hazardous through inhalation, skin absorption, and ingestion, and produces local skin/eye impacts. Causes irritation of the eyes and respiratory system with possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed.

Used in the manufacture of pesticides; and as a solvent, cleaner, and rust inhibitor.

This material is on the NRL Critical Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 5.85 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 10 ppm; Mar: 26 ppm; Crit: 103 ppm; Cat: —
PAC-1: 9.9 ppm; *PAC-2:* 26 ppm; *PAC-3:* 260 ppm
PEL: 15 ppm [Skin]
REL: 5 ppm [Skin]
TLV: 5 ppm [Skin]
$Ceiling_{(ACGIH)}$: 10 ppm [Skin]
$STEL_{(NIOSH)}$: 10 ppm [Skin]
IDLH: 100 ppm [Skin]

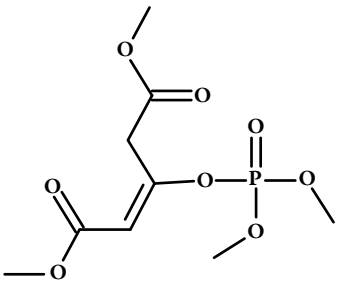
Properties:

MW: 143.0	*VP:* 0.7 mmHg	*FlP:* 131°F
D: 1.2 g/mL	*VD:* 4.9	*LEL:* 2.7%
MP: −58°F	*Vlt:* 900 ppm	*UEL:* —
BP: 352°F	*ER:* —	*RP:* 11
Vsc: 1.8 cS (77°F)	*H_2O:* 1.1% (decomposes)	*IP:* 9.85 eV
	Sol: Most organic solvents	

C11-A018

Bomyl

CAS: 122-10-1
RTECS: LZ9450000
UN: —
EC: —
UNII: 3RW2BG7YNB
ICD-11: —



$C_9\ H_{15}\ O_8\ P$

Yellow oily liquid. Commercial grade is 80%–90% agent. Both geometric isomers have similar toxicity. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. It is a cholinesterase inhibitor. This material is absorbed through the skin very quickly.

Used as an agricultural pesticide.

Exposure Hazards

Conversion Factor: 1 ppm = 11.54 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties (commercial grade):

MW: 282.2	*VP:* 25 mmHg (77°F)	*FlP:* NA
D: 1.2 g/mL	*VD:* 9.7	*LEL:* NA
MP: 77°F	*Vlt:* —	*UEL*: NA
BP: 311–329°F (17 mmHg)	*ER:* —	*RP:* 0.24
Vsc: —	*H_2O:* Practically insoluble *Sol:* Alcohols, acetone, xylene, propylene glycol	*IP:* —

C11-A019

Boron Tribromide

CAS: 10294-33-4
RTECS: ED7400000
UN: 2692; 157
EC: 233-657-9
UNII: A453DV9339
ICD-11: —

BBr_3

Colorless, fuming liquid with a pungent, sharp, irritating odor. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts. Violent irritant; contact produces first- and second-degree burns, severe eye, and respiratory irritation with difficulty breathing (dyspnea) and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed.

Used industrially in the manufacture of diborane, ultra-high purity boron, and semiconductors; used as a catalyst in polymerizations, alkylations, and acylations

This material is on the DHS Chemicals of Interest list, ITF-25 Medium Threat list and NRL Critical Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 10.25 mg/m^3 at 77°F
$MEC_{(1hr)}$: Neg: 0.33 ppm; Mar: 7.3 ppm; Crit: 40 ppm; Cat: —
PAC-1: 0.33 ppm; *PAC-2:* 13 ppm; *PAC-3:* 40 ppm
$Ceiling_{(ACGIH)}$: 0.7 ppm
$Ceiling_{(NIOSH)}$: 1 ppm

Final AEGLs
AEGL-1: 1 hr – 0.33 ppm; 4 hr – 0.33 ppm; 8 hr – 0.33 ppm
AEGL-2: 1 hr – 13 ppm; 4 hr – 3.3 ppm; 8 hr – 1.7 ppm
AEGL-3: 1 hr – 40 ppm; 4 hr – 10 ppm; 8 hr – 5.0 ppm

Properties:

MW: 250.5	*VP:* 40 mmHg (57°F)	*FlP:* NA
D: 2.6 g/mL (65°F)	*VD:* 8.6	*LEL:* NA
MP: –51°F	*Vlt:* 55,000 ppm (57°F)	*UEL*: NA
BP: 194°F	*ER:* 250	*RP:* 0.1
Vsc: 0.28 cS (75°F)	*H_2O:* Reacts violently	*IP:* 9.70 eV
	Sol: Carbon tetrachloride, carbon disulfide	

C11-A020

Boron Trichloride
CAS: 10294-34-5
RTECS: ED1925000
UN: 1741; 125
EC: 233-658-4
UNII: K748471RAG
ICD-11: —

BCl_3
Colorless fuming liquid with a sharp, irritating, pungent odor. This material is hazardous through inhalation and produces local skin/eye impacts. Violent irritant; contact produces first- and second-degree burns, severe eye, and respiratory irritation with difficulty breathing (dyspnea) and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed.

Used industrially for the production and purification of boron and boron compounds; in purification of metal alloys to remove oxides, nitrides, and carbides; as a soldering flux for alloys of aluminum, iron, zinc, tungsten, and Monel; as an extinguishing agent for magnesium fires in heat treating furnaces; as a stabilizer for liquid sulfur trioxide; for the manufacture of boron filaments for advanced composites and in semiconductors It has been used in the field of high energy fuels and rocket propellants as a source of boron for raising the BTU value.

This material is on the DHS Chemicals of Interest list, ITF-25 High Threat list and NRL Critical Threat list.

Exposure Hazards
Conversion Factor: 1 ppm = 4.79 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.31 ppm; Mar: 2.1 ppm; Crit: 2.7 ppm; Cat: —
PAC-1: 0.19 ppm; *PAC-2:* 2.1 ppm; *PAC-3:* 71 ppm
$Ceiling_{(ACGIH)}$: 0.7 ppm

Properties:

MW: 117.2	*VP:* 1,125 mmHg	*FlP:* NA
D: 1.3 g/mL (liq. gas, 77°F)	*VD:* 4.0	*LEL:* NA
MP: –161°F	*Vlt:* NA	*UEL*: NA

BP: 54°F	*ER:* 270	*RP:* NA
Vsc: 0.17 cS (liq. gas, 77°F)	H_2O: Reacts	*IP:* 11.62 eV
	Sol: Carbon tetrachloride	

C11-A021

Bromine Chloride
CAS: 13863-41-7
RTECS: EF9200000
UN: 2901; 124
EC: 237-601-4
UNII: 7G62XY5724
ICD-11: —

BrCl
Reddish-yellow mobile liquid or gas with an irritating odor. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts. Contact produces first- and second-degree burns, severe eye irritation with tearing (lacrimation). Severe respiratory irritant with difficulty breathing (dyspnea) and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed.

Used industrially as a disinfectant and in some lithium/sulfur dioxide batteries.

This material is on the DHS Chemicals of Interest list and ITF-25 Low Threat list.

Exposure Hazards
Conversion Factor: 1 ppm = 4.72 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.51 ppm; Mar: 2.5 ppm; Crit: 7.6 ppm; Cat: —
PAC-1: 0.074 ppm; *PAC-2:* 0.83 ppm; *PAC-3:* 2.5 ppm

Final AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 0.83 ppm; 4 hr – 0.53 ppm; 8 hr – 0.37 ppm
AEGL-3: 1 hr – 2.5 ppm; 4 hr – 1.6 ppm; 8 hr – 1.1 ppm

Properties:

MW: 115.4	*VP:* —	*FlP:* NA
D: 2.17 g/mL	*VD:* 4.0	*LEL:* NA
MP: –87°F	*Vlt:* —	*UEL*: NA
BP: 41°F	*ER:* 270	*RP:* —
Vsc: 0.0081 cS	H_2O: Soluble (reacts)	*IP:* 11.01
	Sol: Ether, carbon disulfide	

C11-A022

Boron Trifluoride
CAS: 7637-07-2
RTECS: ED2275000
UN: 1008; 125 / 3519; 173 (Absorbed)
EC: 231-569-5
UNII: 7JGD48PX8P
ICD-11: XM5AP1

BF_3

Colorless gas with a pungent, suffocating odor. This material is hazardous through inhalation and produces local skin/eye impacts. Contact produces severe irritation with first- and second-degree skin and eye burns. Respiratory irritation with difficulty breathing (dyspnea) and possible inflammation of lung tissue (pneumonitis). Symptoms may be delayed.

Used industrially as a catalyst in organic synthesis, to protect molten magnesium and its alloys from oxidation, as a flux for soldering magnesium; manufacture of specialty electronics; as a fumigant; and in ionization chambers for detection of weak neutrons.

This material is on the DHS Chemicals of Interest list, ITF-25 High Threat list and NRL Critical Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 2.77 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.90 ppm; Mar: 13 ppm; Crit: 40 ppm; Cat: —
PAC-1: 0.90 ppm; *PAC-2:* 10 ppm; *PAC-3:* 32 ppm
TLV: 0.1 ppm
$Ceiling_{(ACGIH)}$: 0.7 ppm
$Ceiling_{(NIOSH)}$: 1 ppm
IDLH: 25 ppm

Final AEGLs
AEGL-1: 1 hr – 0.9 ppm; 4 hr – 0.9 ppm; 8 hr – 0.9 ppm
AEGL-2: 1 hr – 10 ppm; 4 hr – 6.5 ppm; 8 hr – 3.4 ppm
AEGL-3: 1 hr – 32 ppm; 4 hr – 20 ppm; 8 hr – 10 ppm

Properties:

MW: 67.8	*VP:* 36,600 mmHg (8°F)	*FlP:* NA
D: 1.4 g/mL (liq. gas, –94°F)	*VD:* 2.4	*LEL:* NA
MP: –196°F	*Vlt:* NA	*UEL*: NA
BP: –150°F	*ER:* 340	*RP:* NA
Vsc: 0.05 cS (liq. gas, –58°F)	*H_2O:* 106% (cold water, decomposes)	*IP:* 15.50 eV
	Sol: Most hydrocarbons solvents	

C11-A023

Bromine Pentafluoride

CAS: 7789-30-2
RTECS: EF9350000
UN: 1745; 144
EC: 232-157-8
UNII: UPI6B7Y9UQ
ICD-11: —

BrF_5

Colorless to pale-yellow, fuming liquid with a pungent odor. It reacts violently with organic material. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts. Contact produces severe skin and eye irritation with first- and second-degree burns with

blisters (vesiculation). Causes respiratory irritation with difficulty breathing (dyspnea) and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed.

Used industrially as a fluorinating agent and as an oxidizer in rocket propellant systems
This material is on the DHS Chemicals of Interest list and ITF-25 Low Threat list.

Exposure Hazards
Conversion Factor: 1 ppm = 7.15 mg/m^3 at 77°F
MEG$_{(1hr)}$: Neg: 0.14 ppm; Mar: 1.0 ppm; Crit: 34 ppm; Cat: —
PAC-1: 0.015 ppm; *PAC-2:* 0.16 ppm; *PAC-3:* 34 ppm
TLV: 0.1 ppm
IDLH: 1.7 ppm

Final AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 0.17 ppm; 4 hr – 0.082 ppm; 8 hr – 0.057 ppm
AEGL-3: 1 hr – 33 ppm; 4 hr – 8.3 ppm; 8 hr – 4.2 ppm

Properties:

MW: 174.9	*VP:* 328 mmHg	*FlP:* NA
D: 2.5 g/mL	*VD:* 6.1	*LEL:* NA
MP: –79°F	*Vlt:* 440,000 ppm	*UEL*: NA
BP: 105°F	*ER:* 340	*RP:* 0.02
Vsc: 0.19 cS (77°F)	*H_2O:* Reacts violently	*IP:* 13.17 eV
	Sol: —	

C11-A024

Bromine Trifluoride
CAS: 7787-71-5
RTECS: EF9360000
UN: 1746; 144
EC: 232-132-1
UNII: BD697HEL7X
ICD-11: —

BrF_3
Colorless to pale yellow liquid that fumes and smokes in air with an extremely irritating odor. Solid is crystalline material. It reacts violently with organic material. This material is hazardous through inhalation, skin absorption, and ingestion, and produces local skin/eye impacts. Contact produces severe skin and eye irritation with first- and second-degree burns with blisters (vesiculation). Causes respiratory irritation with difficulty breathing (dyspnea) and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed.

Used industrially as a fluorinating agent, electrolytic solvent; used in forming uranium fluorides for isotopic enrichment and fuel element reprocessing.

This material is on the DHS Chemicals of Interest list and the ITF-25 Low Threat list.

Exposure Hazards
Conversion Factor: 1 ppm = 5.60 mg/m^3 at 77°F
MEG$_{(1hr)}$: Neg: 0.12 ppm; Mar: 2.0 ppm; Crit: 21 ppm; Cat: —
PAC-1: 0.12 ppm; *PAC-2:* 2.0 ppm; *PAC-3:* 21 ppm

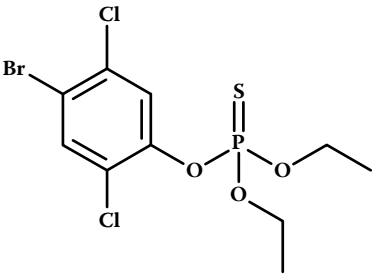
Final AEGLs
AEGL-1: 1 hr – 0.12 ppm; 4 hr – 0.12 ppm; 8 hr – 0.12 ppm
AEGL-2: 1 hr – 2.0 ppm; 4 hr – 0.70 ppm; 8 hr – 0.41 ppm
AEGL-3: 1 hr – 21 ppm; 4 hr – 7.3 ppm; 8 hr – 7.3 ppm

Properties:

MW: 136.9	*VP:* 8 mmHg (70°F)	*FlP:* NA
D: 2.8 g/mL (77°F)	*VD:* 4.7	*LEL:* NA
MP: 48°F	*Vlt:* 11,000 ppm (70°F)	*UEL*: NA
BP: 258°F	*ER:* —	*RP:* 1.1
Vsc: 0.46 cS (77°F)	*H_2O:* Reacts	*IP:* 12.15 eV
	Sol: —	

C11-A025

Bromophos-ethyl
CAS: 4824-78-6
RTECS: TE7000000
UN: —
EC: 225-399-0
UNII: CVT4KYL79N
ICD-11:



C_{10} H_{12} Br Cl_2 O_3 P S

Colorless to pale yellow liquid. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. It is a cholinesterase inhibitor.

Used as an agricultural pesticide.

Exposure Hazards
Conversion Factor: 1 ppm = 16.12 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties (commercial grade):

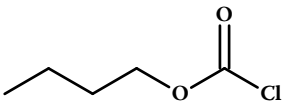
MW: 394.1	*VP:* 4.6×10^{-5} mmHg (86°F)	*FlP:* —
D: 1.5 g/mL	*VD:* 14	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —

BP: 252 – 271°F (0.001 mmHg)	*ER:* —	*RP:* —
Vsc: —	*H_2O:* 4.4 x 10^{-5}%	*IP:* —
	Sol: Most common solvents	

C11-A026

Butyl Chloroformate

CAS: 592-34-7
RTECS: LQ5890000
UN: 2743; 155
EC: 209-750-5
UNII: —
ICD-11: —



C_5 H_9 Cl O_2

Clear, colorless to light yellow liquid with an unpleasant odor. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts. Contact produces severe irritation with first- and second-degree skin and eye burns. Respiratory irritation with difficulty breathing (dyspnea). Symptoms may be delayed.

Used industrially as a chemical intermediate for numerous compounds.

This material is on the ITF-25 Low Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 5.59 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.27 ppm; Mar: 2.1 ppm; Crit: 6.6 ppm; Cat: —
PAC-1: 0.59 ppm; *PAC-2:* 2.1 ppm; *PAC-3:* 6.6 ppm

Final AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 2.2 ppm; 4 hr – 0.57 ppm; 8 hr – 0.28 ppm
AEGL-3: 1 hr – 6.7 ppm; 4 hr – 1.7 ppm; 8 hr – 0.83 ppm

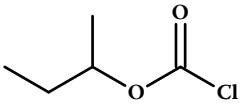
Properties:

MW: 136.6	*VP:* 5.4 mmHg	*FlP:* 77°F
D: 1.1 g/mL	*VD:* 4.7	*LEL:* —
MP: —	*Vlt:* 7,200 ppm	*UEL*: —
BP: 288°F	*ER:* —	*RP:* 1.6
Vsc: 0.90 cS	*H_2O:* Insoluble (decomposes slowly)	*IP:* —
	Sol: —	

C11-A027

s-Butyl Chloroformate

CAS: 17462-58-7
RTECS: —
UN: 2742; 155
EC: 241-475-6
UNII: —
ICD-11: —



C_5 H_9 Cl O_2

Colorless liquid. This material is hazardous through inhalation, skin absorption, and ingestion, and produces local skin/eye impacts. Contact produces severe irritation with first- and second-degree skin and eye burns. Respiratory irritation with difficulty breathing (dyspnea). Symptoms may be delayed.

Used industrially as a chemical intermediate.

This material is on the ITF-25 Low Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 5.59 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.27 ppm; Mar: 2.1 ppm; Crit: 6.6 ppm; Cat: —
PAC-1: 0.20 ppm; *PAC-2:* 2.1 ppm; *PAC-3:* 6.6 ppm

Final AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 2.2 ppm; 4 hr – 0.57 ppm; 8 hr – 0.28 ppm
AEGL-3: 1 hr – 6.7 ppm; 4 hr – 1.7 ppm; 8 hr – 0.83 ppm

Properties:

MW: 136.6	*VP:* 10.60 mmHg	*FlP:* 81°F
D: 1.1 g/mL	*VD:* 4.7	*LEL:* —
MP: –76°F (est.)	*Vlt:* 14,000 ppm	*UEL*: —
BP: 277°F	*ER:* —	*RP:* 0.80
Vsc: —	*H_2O:* Reacts	*IP:* —
	Sol: —	

C11-A028

Butyl Isocyanate

CAS: 111-36-4
RTECS: NQ8250000
UN: 2485; 155
EC: 203-862-8
UNII: XM89T89J3W
ICD-11: —



C_5 H_9 N O

Colorless liquid with a strong odor. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Contact produces first- and second-degree burns, severe eye, and respiratory irritation with difficulty breathing (dyspnea).

Used industrially to manufacture of insecticides, fungicides, and pharmaceuticals.
This material is on the ITF-25 Low Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 4.05 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.013 ppm; Mar: 0.023 ppm; Crit: 0.25 ppm; Cat: —
PAC-1: 0.010 ppm; *PAC-2:* 0.084 ppm; *PAC-3:* 0.25 ppm

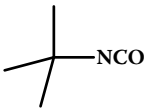
Final AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 0.083 ppm; 4 hr – 0.053 ppm; 8 hr – 0.026 ppm
AEGL-3: 1 hr – 0.25 ppm; 4 hr – 0.16 ppm; 8 hr – 0.078 ppm

Properties:

MW: 99.1	*VP:* 10.6 mmHg	*FlP:* 66°F
D: 0.88 g/mL	*VD:* 3.4	*LEL:* 1.3%
MP: <–94°F	*Vlt:* 14,000 ppm	*UEL*: 10%
BP: 239°F	*ER:* —	*RP:* 0.94
Vsc: —	*H_2O:* Slight (decomposes slowly)	*IP:* 10.14 eV
	Sol: —	

C11-A029

t-Butyl Isocyanate
CAS: 1609-86-5
RTECS: NQ8300000
UN: 2484; 155
EC: 216-544-9
UNII: 2RHQ1BS36D
ICD-11: —



C_5 H_9 N O

Clear, colorless liquid. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Contact produces first- and second-degree burns, severe eye, and respiratory irritation with difficulty breathing (dyspnea).

This material is on the ITF-25 Low Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 4.05 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.19 ppm; Mar: 1.2 ppm; Crit: 6.2 ppm; Cat: —
PAC-1: 0.0099 ppm; *PAC-2:* 0.11 ppm; *PAC-3:* 0.64 ppm

Properties:

MW: 99.1	*VP:* 57 mmHg (77°F)	*FlP:* 24°F
D: 0.84 g/mL	*VD:* 3.4	*LEL:* —
MP: —	*Vlt:* 75,000 ppm (77°F)	*UEL*: —
BP: 183°F	*ER:* 200	*RP:* 0.18
Vsc: —	*H_2O:* Slight (decomposes)	*IP:* 10.14 eV
	Sol: —	

C11-A030

Cadmium

CAS: 7440-43-9; 1306-19-0 (Cadmium oxide)
RTECS: EU9800000; EV1930000 (Fume; Cadmium oxide)
UN: 2570; 154
EC: 231-152-8; 215-146-2 (Cadmium oxide)
UNII: 00BH33GNGH; 0H3KWS8KJ3 (Cadmium oxide)
ICD-11: XM0V73

Cd / CdO

Soft, silvery-white metal that is odorless. Cadmium oxide is an amber to brown amorphous powder that is odorless. Finely divided cadmium metal dust may ignite spontaneously in air to produce cadmium oxide. These materials are hazardous through inhalation, and ingestion, and produces local skin/eye impacts. Causes respiratory irritation with difficulty breathing (dyspnea) and accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed. Ingestion produces abdominal cramps. nausea, vomiting and diarrhea.

Metal is used as a coating, as a component in various alloys, a component of solders, and in rechargeable batteries. Cadmium oxide is used in storage batteries, as a component in heat-resistant plastics and rubbers, and in ceramic glazes.

This material is the NRL Critical Threat list.

Exposure Hazards

Conversion Factor: NA
$MEG_{(1hr)}$: Neg: 0.10 mg/m^3; Mar: 0.76 mg/m^3; Crit: 4.7 mg/m^3; Cat: —
PAC-1: 0.10 mg/m^3; *PAC-2:* 0.76 mg/m^3; *PAC-3:* 4.7 mg/m^3
PEL: 0.005 mg/m^3 (as cadmium)
$TLV_{(Cd\ metal)}$: 0.01 mg/m^3
$TLV_{(Cd\ oxide)}$: 0.002 mg/m^3 (as cadmium)
IDLH: 9 mg/m^3 (as cadmium)

Interim AEGLs
AEGL-1: 1 hr – 0.10 mg/m^3; 4 hr – 0.063 mg/m^3; 8 hr – 0.041 mg/m^3
AEGL-2: 1 hr – 0.76 mg/m^3; 4 hr – 0.40 mg/m^3; 8 hr – 0.20 mg/m^3
AEGL-3: 1 hr – 4.7 mg/m^3; 4 hr – 1.9 mg/m^3; 8 hr – 0.93 mg/m^3

Properties:

MW: 112.4	*VP:* —	*FlP:* —
D: 8.7 g/cm^3	*VD:* —	*LEL:* —
MP: 609°F	*Vlt:* —	*UEL*: —
BP: 1,413°F (sublimes)	*ER:* —	*RP:* —
Vsc: —	*H_2O:* Insoluble	*IP:* —
	Sol: —	

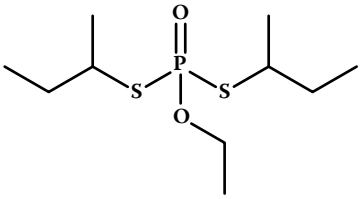
Cadmium Oxide:

MW: 128.4	*VP:* —	*FlP:* —
D: 8.2 g/cm^3	*VD:*	*LEL:* —
MP: 2,599°F	*Vlt:* —	*UEL*: —
BP: 2,838°F (sublimes)	*ER:* —	*RP:* —
Vsc: —	*H_2O:* Insoluble	*IP:* —
	Sol: —	

C11-A031

Cadusafos

CAS: 95465-99-9
RTECS: TE3800000
UN: —
EC: —
UNII: CADUSAFOS
ICD-11: XM2JZ1



C_{10} H_{23} O_2 P S_2

Colorless to yellow liquid that is odorless. Commercial material has a flat, musty odor due to impurities. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. It is a cholinesterase inhibitor. Used industrially as an insecticide and nematicide.

This material is the Australia Chemicals of Security Concern list.

Exposure Hazards

Conversion Factor: 1 ppm = 11.06 mg/m^3 at 77°F
TLV: 0.001 mg/m^3 [Skin]

Properties:

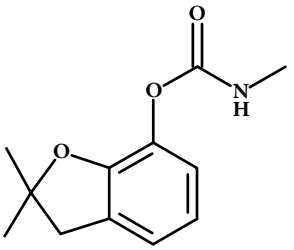
MW: 270.4	*VP:* 9 × 10^{-4} mmHg (77°F)	*FlP:* 265°F
D: 1.1 g/cm^3	*VD:* 9.3	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —

BP: 234°F (0.8 mmHg)	*ER:* —	*RP:* 6,800
Vsc: —	H_2O: 0.02% (77°F)	*IP:* —
	Sol: Acetone, acetonitrile, ethyl acetate, alcohols	

C11-A032

Carbofuran

CAS: 1563-66-2
RTECS: FB9450000
UN: —
EC: 216-353-0
UNII: SKF77S6Y67
ICD-11: XM7A68



C_{12} H_{15} N O_3

White to grayish crystalline solid. It is odorless when pure but impurities may give it an odor similar to phenol. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts. It is a cholinesterase inhibitor.

Used industrially as a soil insecticide, acaricide and nematicide.

This material is on the FBI list and Australia Chemicals of Security Concern list.

Exposure Hazards

Conversion Factor: 1 ppm = 9.05 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.30 mg/m^3; Mar: 0.43 mg/m^3; Crit: 0.50 mg/m^3; Cat: —
PAC-1: 0.30 mg/m^3; *PAC-2:* 0.43 mg/m^3; *PAC-3:* 3.7 mg/m^3
REL: 0.1 mg/m^3
TLV: 0.1 mg/m^3

Properties:

MW: 221.3	*VP:* 3.4×10^{-6} mmHg (77°F)	*FlP:* NA
D: 1.2 g/cm^3	*VD:* 7.6	*LEL:* NA
MP: 304°F	*Vlt:* —	*UEL*: NA
BP: Decomposes	*ER:* —	*RP:* —
Vsc: —	H_2O: 0.07% (77°F)	*IP:* —
	Sol: Acetone, acetonitrile, dimethylformamide, dimethyl sulfoxide	

C11-A033

Carbon Disulfide

CAS: 75-15-0
RTECS: FF6650000
UN: 1131; 131
EC: 200-843-6
UNII: S54S8B99E8
ICD-11: XM7S46

CS_2

Colorless to faint-yellow mobile liquid with a sweet, ethereal odor. On standing, the odor becomes a foul stench. This material is hazardous through inhalation, skin absorption of the liquid, and ingestion, and produces local skin/eye impacts. Contact produces burns with severe eye irritation. Effects include headache, dizziness, nausea, and difficulty breathing (dyspnea).

Carbon disulfide is highly flammable and has an autoignition temperature of 212°F.

Used industrially as a chemical intermediate in the production of rayon, carbon tetrachloride, xanthogenates, flotation agents and pesticides; used in the cold vulcanization of vulcanized rubber, in adhesive compositions for food packaging; as a grain fumigant; as a solvent for phosphorus, sulfur, selenium, bromine, iodine, fats, resins, rubbers, waxes, lacquers, camphor, resins; and in the production of optical glass, paints, enamels, varnishes, paint removers, tallow, putty preservatives, rubber cement, soil disinfectants, explosives, rocket fuel, and electronic vacuum tubes.

This material is on the DHS Chemicals of Interest list, Australia Chemicals of Security Concern list, and ITF-25 High Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 3.11 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 13 ppm; Mar: 160 ppm; Crit: 480 ppm; Cat: —
PAC-1: 13 ppm; *PAC-2:* 160 ppm; *PAC-3:* 480 ppm
PEL: 20 ppm
REL: 1 ppm [Skin]
TLV: 1 ppm [Skin]
$Ceiling_{(OSHA)}$: 30 ppm
$STEL_{(NIOSH)}$: 10 ppm [Skin]
IDLH: 500 ppm [Skin]

Final AEGLs
AEGL-1: 1 hr – 13 ppm; 4 hr – 8.4 ppm; 8 hr – 6.7 ppm
AEGL-2: 1 hr – 160 ppm; 4 hr – 100 ppm; 8 hr – 50 ppm
AEGL-3: 1 hr – 480 ppm; 4 hr – 300 ppm; 8 hr – 150 ppm

Properties:

MW: 76.1	*VP:* 297 mmHg	*FlP:* –22°F
D: 1.3 g/mL	*VD:* 2.7	*LEL:* 1.3%
MP: –169°F	*Vlt:* 400,000 ppm	*UEL*: 50%
BP: 116°F	*ER:* 410	*RP:* 0.038
Vsc: 0.29 cS	*H_2O:* 0.286%	*IP:* 10.08 eV
	Sol: Alcohols, ether, benzene	

C11-A034

Carbonyl Fluoride

CAS: 353-50-4

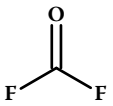
RTECS: FG6125000

UN: 2417; 125

EC: 206-534-2

UNII: 2NU89R5398

ICD-11: —



$C F_2 O$

Hygroscopic colorless gas that fumes in moist air with a very irritating, pungent odor. This material is hazardous through inhalation and produces local skin/eye impacts. Causes skin, eye, and respiratory irritation with difficulty breathing (dyspnea) and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed.

Hydrogen fluoride generated during decomposition poses a significant inhalation and dermal hazard.

Used industrially as a chemical intermediate in organic synthesis. Produced by decomposition of fluorocarbon plastics when heated between 932°F and 1,202°F.

This material is on the DHS Chemicals of Interest list, and ITF-25 Low Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 2.70 mg/m^3 at 77°F

$MEG_{(1hr)}$*:* Neg: —; Mar: 0.28 ppm; Crit: 0.81 ppm; Cat: —

PAC-1: 0.026 ppm; *PAC-2:* 0.28 ppm; *PAC-3:* 0.81 ppm

REL: 2 ppm

TLV: 2 ppm

$STEL_{(ACGIH)}$*:* 5 ppm

$STEL_{(NIOSH)}$*:* 5 ppm

Final AEGLs

AEGL-1: Not Developed

AEGL-2: 1 hr – 0.28 ppm; 4 hr – 0.17 ppm; 8 hr – 0.087 ppm

AEGL-3: 1 hr – 0.83 ppm; 4 hr – 0.52 ppm; 8 hr – 0.26 ppm

Properties:

MW: 66.0	*VP:* 42,000 mmHg	*FlP:* NA
D: 0.99 g/mL (liq. gas, –58°F)	*VD:* 2.3	*LEL:* NA
MP: –168°F	*Vlt:* NA	*UEL*: NA
BP: –120°F	*ER:* 270	*RP:* NA
Vsc: —	H_2O*:* Reacts	*IP:* 13.02 eV
	Sol: —	

C11-A035

Carbonyl Sulfide

CAS: 463-58-1
RTECS: FG6400000
UN: 2204; 119
EC: 207-340-0
UNII: 871UI0ET21
ICD-11: —

O═C═S

C O S

Colorless gas with an odor of rotten eggs detectable at ≥0.055 ppm. This material is hazardous through inhalation and produces local skin/eye impacts. Causes skin and eye irritation; produces neural lesions. Inhalation can lead to respiratory failure.

Used industrially as a chemical intermediate for alkyl carbonates and organic sulfur compounds; and as a fumigant.

This material is on the DHS Chemicals of Interest list and ITF-25 Medium Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 2.46 mg/m^3 at 77°F
MEG$_{(1hr)}$: Neg: 30 ppm; Mar: 57 ppm; Crit: 150 ppm; Cat: —
PAC-1: 15 ppm; *PAC-2:* 57 ppm; *PAC-3:* 150 ppm
TLV: 5 ppm

Interim AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 55 ppm; 4 hr – 34 ppm; 8 hr – 23 ppm
AEGL-3: 1 hr – 150 ppm; 4 hr – 95 ppm; 8 hr – 48 ppm

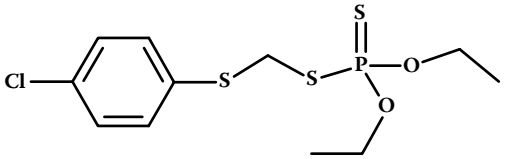
Properties:

MW: 60.1	*VP:* 9,412 mmHg (77°F)	*FlP:* —
D: 1.0 g/mL (liq. gas, 77°F)	*VD:* 2.1	*LEL:* 12%
MP: –218°F	*Vlt:* NA	*UEL*: 28.5%
BP: –58°F	*ER:* 410	*RP:* NA
Vsc: 0.092 cS (liq. gas, 77°F)	*H_2O:* 0.12% (77°F)	*IP:* 11.18 eV
	Sol: Alcohol, toluene, carbon disulfide	

C11-A036

Carbophenothion

CAS: 786-19-6
RTECS: TD5250000
UN: —
EC: 212-324-1
UNII: 998NGA2Q61
ICD-11: XM8AZ4



C_{11} H_{16} Cl O_2 P S_3

Colorless to light amber liquid with a foul odor. Commercial grade is 95% agent. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. This material is absorbed through the skin very quickly. It is a cholinesterase inhibitor.

Used as an agricultural pesticide.

Exposure Hazards

Conversion Factor: 1 ppm = 14.02 mg/m^3 at 77°F
$LD_{50\ (Ing)}$: 0.6 g (est.)
$MEG_{(1hr)}$: Neg: 4.0 mg/m^3; Mar: —; Crit: 6.8 mg/m^3; Cat: —
PAC-1: 0.62 mg/m^3; *PAC-2:* 6.8 mg/m^3; *PAC-3:* 24 mg/m^3

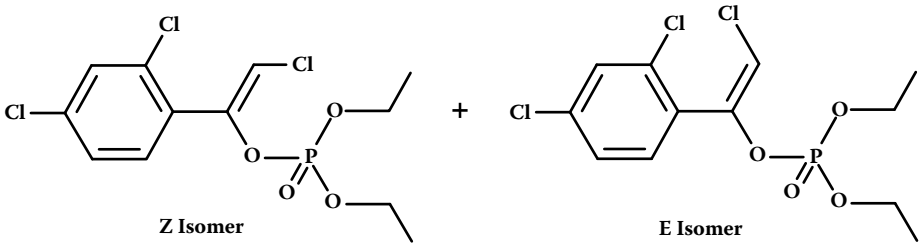
Properties (commercial grade):

MW: 342.9	*VP:* 3×10^{-7} mmHg	*FlP:* —
D: 1.3 g/mL	*VD:* 12	*LEL:* —
MP: —	*Vlt:* —	*UEL:* —
BP: 180°F (0.01 mmHg)	*ER:* —	*RP:* —
Vsc: —	*H_2O:* 6×10^{-6}%	*IP:* —
	Sol: Most organic solvents	

C11-A037

Chlorfenvinphos

CAS: 470-90-6
RTECS: TB8750000
UN: —
EC: 207-432-0
UNII: F2G9XS1W91
ICD-11: XM20D7



C_{12} H_{14} Cl_3 O_4 P

Colorless to yellow to amber liquid with a mild odor. Commercial grade is 90% agent. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. It is a cholinesterase inhibitor.

Used as an agricultural pesticide.

This material is on the Australia Chemicals of Security Concern list.

Exposure Hazards

Conversion Factor: 1 ppm = 14.71 mg/m^3 at 77°F
MEG$_{(1hr)}$: Neg: 6.0 mg/m^3; Mar: —; Crit: 10 mg/m^3; Cat: —
PAC-1: 0.91 mg/m^3; *PAC-2:* 10 mg/m^3; *PAC-3:* 500 mg/m^3

Properties (commercial grade):

MW: 359.6	*VP:* 7.5 × 10^{-6} mmHg (77°F)	*FlP:* NA
D: 1.4 g/mL	*VD:* 12	*LEL:* NA
MP: −9 to −2°F	*Vlt:* —	*UEL*: NA
BP: 333°F (0.5 mmHg)	*ER:* —	*RP:* —
Vsc: —	*H_2O:* 0.012% (slowly decomposes)	*IP:* —
	Sol: Most organic solvents	

C11-A038
Chlorine Dioxide
CAS: 10049-04-4
RTECS: FO3000000
UN: 9191; 143 (Hydrate, frozen)
EC: 233-162-8
UNII: 8061YMS4RM
ICD-11: —

ClO_2

Yellow to reddish-yellow gas, red-brown liquid, or orange solid with a chlorine odor detectable at ≥0.1 ppm. This material is hazardous through inhalation, ingestion (solutions), and produces local skin/eye impacts. Causes severe skin, eye, and respiratory irritation with difficulty breathing (dyspnea) and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed.

Concentrated gas (>10%) is potentially explosive. Reacts violently with organic material; decomposes rapidly in sunlight into chlorine gas and oxygen.

Used industrially as a bleaching agent for flour and paper; uses as a bactericide in water purification.

This material is the DHS Chemicals of Interest list and NRL Critical Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 2.76 mg/m^3 at 77°F
Irritation: 5 ppm; exposure duration unspecified
MEG$_{(1hr)}$: Neg: 0.15 ppm; Mar: 1.1 ppm; Crit: 2.4 ppm; Cat: —
PAC-1: 0.15 ppm; *PAC-2:* 1.1 ppm; *PAC-3:* 2.4 ppm
PEL: 0.1 ppm
REL: 0.1 ppm
Ceiling$_{(ACGIH)}$: 0.1 ppm
STEL$_{(NIOSH)}$: 0.3 ppm
IDLH: 5 ppm

Final AEGLs
AEGL-1: 1 hr – 0.15 ppm; 4 hr – 0.15 ppm; 8 hr – 0.15 ppm
AEGL-2: 1 hr – 1.1 ppm; 4 hr – 0.69 ppm; 8 hr – 0.45 ppm
AEGL-3: 1 hr – 2.4 ppm; 4 hr – 1.5 ppm; 8 hr – 0.98 ppm

Properties:

MW: 67.5	*VP:* >760 mmHg	*FlP:* NA
D: 1.6 g/mL (liq. gas, 32°F)	*VD:* 2.3	*LEL:* NA
MP: –74°F	*Vlt:* NA	*UEL*: NA
BP: 52°F	*ER:* 530	*RP:* NA
Vsc: —	*H_2O:* 0.3% (77°F)	*IP:* 10.36 eV
	Sol: —	

C11-A039
Chlorine Pentafluoride
CAS: 13637-63-3
RTECS: FO2975000
UN: 2548; 124
EC: 237-123-6
UNII: O4RJ1HW01H
ICD-11: —

ClF_5
Colorless fuming gas with a pungent, sweet odor. This material is hazardous through inhalation and produces local skin/eye impacts. Causes severe skin, eye, and respiratory irritation with difficulty breathing (dyspnea) and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed.

Reacts violently with water and organic material.

Used industrially as a fluorinating agent and in wood pulp bleaching.

This material is on the ITF-25 Low Threat list.

Exposure Hazards
Conversion Factor: 1 ppm = 5.34 mg/m^3 at 77°F
$LC_{50\ (Inh)}$: 150 ppm for a 1-hour exposure
$MEG_{(1hr)}$: Neg: 0.30 ppm; Mar: 0.99 ppm; Crit: 8.1 ppm; Cat: —
PAC-1: 0.016 ppm; *PAC-2:* 0.17 ppm; *PAC-3:* 8.1 ppm
IDLH: 1.7 ppm

Final AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 0.17 ppm; 4 hr – 0.082 ppm; 8 hr – 0.057 ppm
AEGL-3: 1 hr – 8.0 ppm; 4 hr – 3.9 ppm; 8 hr – 2.7 ppm

Properties:

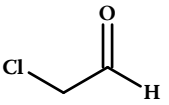
MW: 130.4	*VP:* 2,550 mmHg	*FlP:* NA
D: 1.9 g/mL (liq. gas)	*VD:* 4.5	*LEL:* NA
MP: –152°F	*Vlt:* NA	*UEL*: NA

BP: 9.1°F	*ER:* 350	*RP:* NA
Vsc: —	*H_2O:* Reacts	*IP:* 13.54
	Sol: —	

C11-A040

Chloroacetaldehyde

CAS: 107-20-0
RTECS: AB2450000
UN: 2232; 153
EC: 203-472-8
UNII: CF069F5D9C
ICD-11: —



C_2 H_3 Cl O

Clear colorless liquid with an acrid, penetrating odor detectable at ≥0.9 ppm. Typically found as a 40% aqueous solution. This material is hazardous through inhalation, skin absorption, and ingestion, and produces local skin/eye impacts. Contact produces first- and second-degree burns, severe skin, eye, and respiratory irritation with difficulty breathing (dyspnea) and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed. It causes sensitization through both inhalation and skin contact.

Used industrially as a chemical intermediate; used agriculturally to facilitate bark removal from tree trunks and as a fungicide

This material is on the ITF-25 Low Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 3.21 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 2.2 ppm; Mar: —; Crit: 10 ppm; Cat: —
PAC-1: 1.3 ppm; *PAC-2:* 2.2 ppm; *PAC-3:* 10 ppm
$Ceiling_{(OSHA)}$: 1 ppm
$Ceiling_{(ACGIH)}$: 1 ppm
$Ceiling_{(NIOSH)}$: 1 ppm
IDLH: 45 ppm

Final AEGLs
AEGL-1: 1 hr – 1.3 ppm; 4 hr – 0.40 ppm; 8 hr – 0.22 ppm
AEGL-2: 1 hr – 2.2 ppm; 4 hr – 0.69 ppm; 8 hr – 0.39 ppm
AEGL-3: 1 hr – 9.9 ppm; 4 hr – 3.1 ppm; 8 hr – 1.8 ppm

Properties:

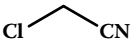
MW: 78.5	*VP:* 100 mmHg (40% solution)	*FlP:* 190°F (40% solution)
D: 1.2 g/mL (40% solution)	*VD:* 2.7	*LEL:* 3.9%
MP: −3°F (40% solution)	*Vlt:* 130,000 ppm	*UEL*: 9%

BP: 185°F	*ER:* —	*RP:* —
Vsc: —	*H_2O:* Miscible	*IP:* 10.61 eV
	Sol: Ether, acetone, methanol	

C11-A041

Chloroacetonitrile

CAS: 107-14-2
RTECS: AL8225000
UN: 2668; 131
EC: 203-467-0
UNII: CN524K9DXD
ICD-11: —



C_2 H_2 Cl N

Clear colorless liquid with a pungent odor. This material is hazardous through inhalation, skin absorption, and ingestion, and produces local skin/eye impacts. Causes severe eye and respiratory irritation with difficulty breathing (dyspnea) then unconsciousness. Lacrimation usually gives adequate warning of vapor exposure.

Used to manufacture insecticides and pharmaceuticals; used agriculturally as a fumigant.

This material is on the ITF-25 Medium Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 3.09 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 4.2 ppm; Mar: 32 ppm; Crit: 68 ppm; Cat: —
PAC-1: 0.45 ppm; *PAC-2:* 4.9 ppm; *PAC-3:* 15 ppm
IDLH: 14 ppm

Final AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 5.0 ppm; 4 hr – 2.1 ppm; 8 hr – 1.4 ppm
AEGL-3: 1 hr – 15 ppm; 4 hr – 6.4 ppm; 8 hr – 4.2 ppm

Properties:

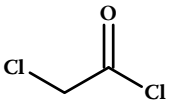
MW: 75.5	*VP:* 8.7 mmHg	*FlP:* 133°F
D: 1.2 g/mL	*VD:* 2.6	*LEL:* 1%
MP: —	*Vlt:* 12,000 ppm	*UEL:* —
BP: 257°F	*ER:* —	*RP:* 1.3
Vsc: —	*H_2O:* 1%	*IP:* 11.95 eV
	Sol: Hydrocarbons, alcohols, ether	

C11-A042

Chloroacetyl Chloride

CAS: 79-04-9
RTECS: AO6475000
UN: 1752; 156

EC: 201-171-6
UNII: K5UML06YUO
ICD-11: —



$C_2 H_2 Cl_2 O$

Colorless to yellowish liquid with a sharp, pungent and irritating odor detectable at ≥0.140 ppm. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Violent irritant; contact produces first- and second-degree burns with blisters (vesiculation), severe eye and respiratory irritation with difficulty breathing (dyspnea) and blue skin and lips (cyanosis). Symptoms may be delayed.

Used industrially as an intermediate in the manufacture of chloroacetophenone, herbicides, pharmaceuticals, and organic chemical synthesis.

This material is on the ITF-25 Low Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 4.62 mg/m^3 at 77°F
Eye Irritation: 1 ppm; exposure duration unspecified
$MEG_{(1hr)}$: Neg: 0.040 ppm; Mar: 1.6 ppm; Crit: 52 ppm; Cat: —
PAC-1: 0.039 ppm; *PAC-2:* 1.6 ppm; *PAC-3:* 52 ppm
REL: 0.05 ppm
TLV: 0.05 ppm [Skin]
$STEL_{(ACGIH)}$: 0.15 ppm [Skin]
IDLH: 1.3 ppm [Skin]

Interim AEGLs
AEGL-1: 1 hr – 0.040 ppm; 4 hr – 0.040 ppm; 8 hr – 0.040 ppm
AEGL-2: 1 hr – 1.6 ppm; 4 hr – 0.40 ppm; 8 hr – 0.20 ppm
AEGL-3: 1 hr – 52 ppm; 4 hr – 13 ppm; 8 hr – 6.5 ppm

Properties:

MW: 112.9	*VP:* 19 mmHg	*FlP:* NA
D: 1.4 g/mL	*VD:* 3.9	*LEL:* NA
MP: –7°F	*Vlt:* 25,000 ppm	*UEL*: NA
BP: 223°F	*ER:* —	*RP:* 0.49
Vsc: 0.15 cS	*H_2O:* Insoluble (decomposes slowly)	*IP:* 10.30 eV
	Sol: Ethyl ether, acetone, benzene	

C11-A043

Chloroform

CAS: 67-66-3
RTECS: FS9100000
UN: 1888; 151
EC: 200-663-8
UNII: 7V31YC746X
ICD-11: XM7MX5

$CHCl_3$

Clear, colorless liquid with a pleasant, nonirritating odor and sweet taste. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Effects include central nervous system depression and unconsciousness. Used industrially as a solvent, intermediate for dyes and pesticides, and an insecticidal fumigant.

This material is on the DHS Chemicals of Interest list.

Exposure Hazards

Conversion Factor: 1 ppm = 4.88 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 10 ppm; Mar: 64 ppm; Crit: 3,300 ppm; Cat: —
PAC-1: 2.0 ppm; *PAC-2:* 64 ppm; *PAC-3:* 3,300 ppm
PEL: 50 ppm
TLV: 10 ppm
$STEL_{(NIOSH)}$: 2 ppm
IDLH: 500 ppm

Final AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 64 ppm; 4 hr – 40 ppm; 8 hr – 29 ppm
AEGL-3: 1 hr – 3,200 ppm; 4 hr – 2,000 ppm; 8 hr – 1,600 ppm

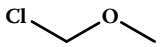
Properties:

MW: 119.4	*VP:* 160 mmHg	*FlP:* NA
D: 1.5 g/mL (77°F)	*VD:* 4.1	*LEL:* NA
MP: –82°F	*Vlt:* 260,000 ppm	*UEL*: NA
BP: 142°F	*ER:* 310	*RP:* 0.05
Vsc: 0.36 cS	*H_2O:* 0.8%	*IP:* 11.42 eV
	Sol: Miscible in alcohol, ether, benzene	

C11-A044

Chloromethyl Methyl Ether

CAS: 107-30-2
RTECS: KN6650000
UN: 1239; 131
EC: 203-480-1
UNII: 334G5B96VG
ICD-11: —



C_2 H_5 O Cl

Colorless to light yellow liquid with an irritating odor. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Violent irritant; contact produces first- and second-degree burns, severe eye, and respiratory irritation with difficulty breathing (dyspnea) and possible inflammation of lung tissue (pneumonitis) with accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed.

Used industrially in organic synthesis, in the manufacture of water repellents, ion-exchange resins, and industrial polymers.

This material is on the DHS Chemicals of Interest list.

Exposure Hazards

Conversion Factor: 1 ppm = 3.29 mg/m^3 at 77°F
MEG$_{(1hr)}$: Neg: 0.23 ppm; Mar: 0.46 ppm; Crit: 2.0 ppm; Cat: —
PAC-1: 0.043 ppm; *PAC-2:* 0.46 ppm; *PAC-3:* 2.0 ppm

Final AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 0.47 ppm; 4 hr – 0.30 ppm; 8 hr – 0.22 ppm
AEGL-3: 1 hr – 2.0 ppm; 4 hr – 1.30 ppm; 8 hr – 0.93 ppm

Properties:

MW: 80.5	*VP:* 184 mmHg	*FlP:* 61°F
D: 1.1 g/mL	*VD:* 2.8	*LEL:* —
MP: –154°F	*Vlt:* 250,000 ppm	*UEL*: —
BP: 139°F	*ER:* 330	*RP:* 0.06
Vsc: 0.20 cS	*H_2O:* Reacts	*IP:* 10.25 eV
	Sol: Ethanol, ether, acetone, chloroform	

C11-A045

Chlorosulfonic Acid (CSA)
CAS: 7790-94-5
RTECS: FX5730000
UN: 1754; 137
EC: 232-234-6
UNII: 2O9AXL1TJ4
ICD-11: —

$ClSO_3H$

Colorless to light yellow liquid with a pungent odor. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts. Contact causes redness, pain, first- and second-degree burns, severe eye and respiratory irritation with difficulty breathing (dyspnea) and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed.

Used industrially as in the manufacture of dyes pesticides, pharmaceuticals, surfactants, for
This material is on the DHS Chemicals of Interest list and NRL Critical Threat list.

This material has been used by the U.S. military as a smoke producing component in formulation FS.

Exposure Hazards

Conversion Factor: 1 ppm = 4.77 mg/m^3 at 77°F
MEG$_{(1hr)}$: Neg: 0.10 ppm; Mar: 0.92 ppm; Crit: 5.2 ppm; Cat: —
PAC-1: 0.021 ppm; *PAC-2:* 0.92 ppm; *PAC-3:* 5.2 ppm

Interim AEGLs
AEGL-1: 1 hr – 0.021 ppm; 4 hr – 0.021 ppm; 8 hr – 0.021 ppm
AEGL-2: 1 hr – 0.92 ppm; 4 hr – 0.92 ppm; 8 hr – 0.92 ppm
AEGL-3: 1 hr – 5.2 ppm; 4 hr – 1.3 ppm; 8 hr – 1.3 ppm

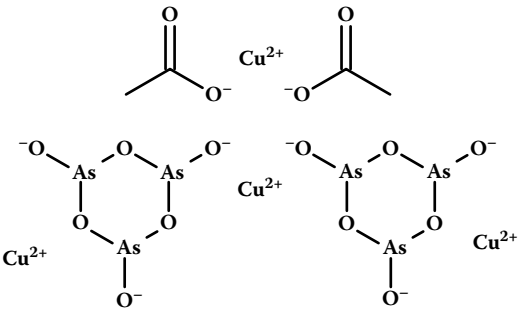
Properties:

MW: 116.5	*VP:* 1.55 mmHg	*FlP:* NA
D: 1.76 g/mL	*VD:* 4.0	*LEL:* NA
MP: –112°F	*Vlt:* 2,100 ppm	*UEL*: NA
BP: 306°F	*ER:* —	*RP:* 5.9
Vsc: —	*H_2O:* Reacts	*IP:* —
	Sol: Dichloromethane, pyridine	

C11-A046

Copper Acetoarsenite

CAS: 12002-03-8
RTECS: GL6475000
UN: 1585; 151
EC: —
UNII: X4916E1P1M
ICD-11: —



C_4 H_6 As_6 Cu_4 O_{16}

Brilliant bluish-green or deep green, odorless powder. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts. Inhalation causes headache, dizziness, and weakness (lassitude). with difficulty breathing (dyspnea). Symptoms may be delayed.

Used industrially as an insecticide, fungicide, wood preservative; as a paint pigment, in fireworks, and a veterinary medication.

This material is on the FBI list.

Exposure Hazards

$MEG_{(1hr)}$: Neg: 3.4 mg/m^3; Mar: —; Crit: 22 mg/m^3; Cat: —
PAC-1: 3.4 mg/m^3; *PAC-2:* 22 mg/m^3; *PAC-3:* 130 mg/m^3
PEL: 0.010 mg/m^3 as arsenic
$Ceiling_{(NIOSH)}$: 0.002 mg/m^3 as arsenic
IDLH: 5 mg/m^3 as arsenic

Properties:

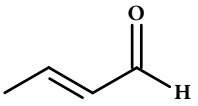
MW: 1,013.8	*VP:* Negligible	*FlP:* NA
D: 1.1 g/cm^3	*VD:* —	*LEL:* NA
MP: Decomposes	*Vlt:* NA	*UEL*: NA

BP: —	*ER:* NA	*RP:* —
Vsc: —	*H_2O:* Insoluble	*IP:* —
	Sol: —	

C11-A047

Crotonaldehyde

CAS: 4170-30-3; 123-73-9 (Trans); 15798-64-8 (Cis)
RTECS: GP9499000
UN: 1143; 131P
EC: 224-030-0; 204-647-1 (Trans)
UNII: 9G72074TUW; 6PUW625907 (Trans); RB9WCA91QT (Cis)
ICD-11: —



C_4 H_6 O

Water-white liquid that becomes pale-yellow on contact with air. It has a tarry, extremely irritating and suffocating odor that is detectable at ≥0.13 ppm. It exists as two configurational isomers. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Contact produces a burning sensation with redness and pain. Severe respiratory irritation with difficulty breathing (dyspnea) and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed.

Used industrially in the manufacture of butyl alcohol, butyraldehyde, quinaldine, resins, rubber antioxidants, insecticides and other chemicals; used as a solvent, warning agent in fuel gases, as a rubber accelerator, in leather tanning and as a denaturant in alcohol

This material is on the DHS Chemicals of Interest list and ITF-25 Low Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 2.87 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.19 ppm; Mar: 4.5 ppm; Crit: 14 ppm; Cat: —
PAC-1: 0.19 ppm; *PAC-2:* 4.5 ppm; *PAC-3:* 14 ppm (for the cis isomer)
PEL: 2 ppm
REL: 2 ppm
$Ceiling_{(ACGIH)}$: 0.3 ppm [Skin]
IDLH: 50 ppm

Final AEGLs (for cis isomer)
AEGL-1: 1 hr – 0.19 ppm; 4 hr – 0.19 ppm; 8 hr – 0.19 ppm
AEGL-2: 1 hr – 4.4 ppm; 4 hr – 1.1 ppm; 8 hr – 0.56 ppm
AEGL-3: 1 hr – 14 ppm; 4 hr – 2.6 ppm; 8 hr – 1.5 ppm

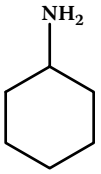
Properties:

MW: 70.1	*VP:* 19 mmHg	*FlP:* 55°F
D: 0.89 g/mL	*VD:* 2.4	*LEL:* 2.1%
MP: –105°F	*Vlt:* 25,000 ppm	*UEL*: 15.5%

BP: 219°F	*ER:* —	*RP:* 0.62
Vsc: 0.88 cS	*H_2O:* 18.1%	*IP:* 9.73 eV
	Sol: Alcohol, ether, toluene	

C11-A048

Cyclohexylamine
CAS: 108-91-8
RTECS: GX0700000
UN: 2357; 132
EC: 203-629-0
UNII: I6GH4W7AEG
ICD-11: —



$C_6\ H_{13}\ N$

Colorless or yellow liquid with a strong fishy or amine odor. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts.

Contact produces first- and second-degree burns, severe eye and respiratory irritation. Inhalation causes central nervous system depression, difficulty breathing (dyspnea) and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed.

Used in the manufacture of insecticides, plasticizers, emulsifying agents, dry-cleaning soaps, and acid gas absorbents. Used as a boiler water treatment and rubber accelerator.

This material is on the DHS Chemicals of Interest list.

Exposure Hazards
Conversion Factor: 1 ppm = 4.06 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 1.8 ppm; Mar: 8.6 ppm; Crit: 30 ppm; Cat: —
PAC-1: 1.8 ppm; *PAC-2:* 8.6 ppm; *PAC-3:* 30 ppm
REL: 10 ppm
TLV: 10 ppm

Final AEGLs
AEGL-1: 1 hr – 1.8 ppm; 4 hr – 1.8 ppm; 8 hr – 1.8 ppm
AEGL-2: 1 hr – 8.6 ppm; 4 hr – 5.4 ppm; 8 hr – 2.7 ppm
AEGL-3: 1 hr – 30 ppm; 4 hr – 19 ppm; 8 hr – 9.5 ppm

Properties:

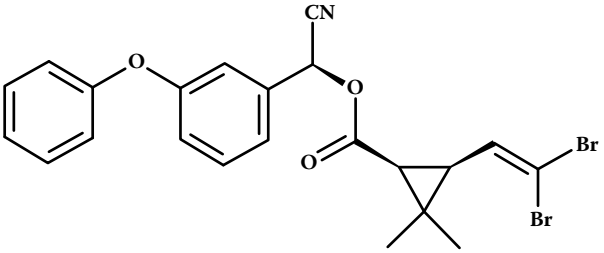
MW: 99.2	*VP:* 11 mmHg	*FlP:* 81°F
D: 0.87 g/mL (77°F)	*VD:* 3.4	*LEL:* 1.6%
MP: 0°F	*Vlt:* 15,000 ppm	*UEL*: 9.4%

BP: 274°F	*ER:* —	*RP:* 0.91
Vsc: 2.5 cS	*H_2O:* Miscible	*IP:* 8.37 eV
	Sol: Miscible in common organic solvents	

C11-A049

Deltamethrin

CAS: 52918-63-5
RTECS: GZ1233000
UN: —
EC: 258-256-6
UNII: 2JTS8R821G
ICD-11: XM3BQ7



C_{22} H_{19} Br_2 N O_3

White or beige crystalline material that is odorless. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts. It is a neurotoxin. Contact produces a burning, prickling, itching, or tingling skin sensation (paresthesia) with redness and pain. Inhalation causes respiratory irritation; ingestion causes unconsciousness and convulsions.

It is a synthetic pyrethroid used as an insecticide and ectoparasiticide.

This material is on the NRL Critical Threat list.

Exposure Hazards

Human toxicity values have not been established or have not been published.

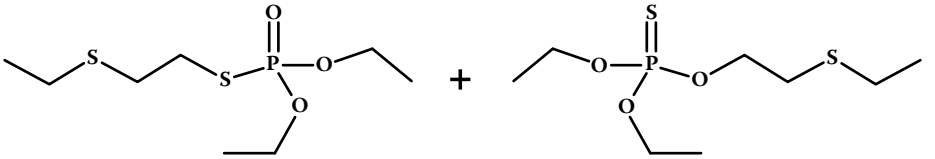
Properties:

MW: 505.2	*VP:* 9.3×10^{-11} mmHg (77°F)	*FlP:* 212°F
D: 0.5 g/cm^3	*VD:* 17(calculated)	*LEL:* —
MP: 208°F	*Vlt:* —	*UEL*: —
BP: Decomposes	*ER:* —	*RP:* —
Vsc: —	*H_2O:* Insoluble	*IP:* —
	Sol: Acetone, dimethyl sulfoxide, xylene	

C11-A050

Demeton

CAS: 8065-48-3
RTECS: TF3150000
UN: —
EC: 206-053-8 (Demeton-O); 204-801-8 (Demeton-S)
UNII: F74QXK6K3Q; 8H0T22KH9W (Demeton-O); 3UQ7N6O63K (Demeton-S)
ICD-11: XM5F29



Demeton-O + Demeton-S

$C_8\ H_{19}\ O_3\ P\ S_2$

Amber, oily liquid with an odor like sulfur. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. It is a cholinesterase inhibitor.

Used as an agricultural pesticide.

Exposure Hazards

Conversion Factor: 1 ppm = 10.57 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.15 mg/m^3; Mar: 2.0 mg/m^3; Crit: 10 mg/m^3; Cat: —
PAC-1: 0.18 mg/m^3; *PAC-2:* 2.0 mg/m^3; *PAC-3:* 20 mg/m^3
PEL: 0.1 mg/m^3 [Skin]
REL: 0.1 mg/m^3 [Skin]
TLV: 0.05 mg/m^3 [Skin]
IDLH: 0.94 mg/m^3 [Skin]

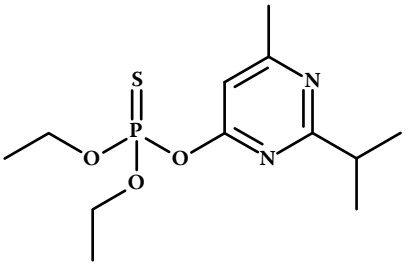
Properties (commercial grade):

MW: 516.7	*VP:* 3×10^{-4} mmHg	*FlP:* 113°F
D: 1.1 g/mL	*VD:* 8.9	*LEL:* —
MP: <–13°F	*Vlt:* —	*UEL*: —
BP: Decomposes	*ER:* —	*RP:* 21,000
Vsc: —	*H_2O:* 0.01%	*IP:* —
	Sol: —	

C11-A051

Diazinon

CAS: 333-41-5
RTECS: TF3325000
UN: —
EC: 206-373-8
UNII: YUS1M1Q929
ICD-11: XM6AY4



$C_{12}\ H_{21}\ N_2\ O_3\ P\ S$

Clear, colorless liquid or oil with a faint ester-like odor. Technical grade is a yellow or pale-to-dark brown liquid. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. It is a cholinesterase inhibitor.

Used as an insecticide, nematicide, and seed treatment/protectant. Also found in cattle ear tags to control flies and ticks.

This material is on the Australia Chemicals of Security Concern list.

Exposure Hazards

Conversion Factor: 1 ppm = 12.45 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: —; Mar: 0.0024 mg/m^3; Crit: 0.010 mg/m^3; Cat: —
REL: 0.1 mg/m^3 [Skin]
TLV: 0.01 mg/m^3 [Skin]

Properties:

MW: 304.4	*VP:* 9.0×10^{-5} mmHg (77°F)	*FlP:* 220°F
D: 1.1 g/mL	*VD:* 11	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 257°F (1 mmHg)	*ER:* —	*RP:* —
Vsc: —	*H_2O:* 0.004%	*IP:* —
	Sol: Miscible in common organic solvents	

C11-A052

Diborane

CAS: 19287-45-7
RTECS: HQ9275000
UN: 1911; 119
EC: 242-940-6
UNII: BS9K982N24
ICD-11: XM70H1

B_2H_6

Colorless gas with a repulsive, sickly sweet odor detectable at ≥3.5 ppm. Industrially, it can be found diluted with a variety of gases including hydrogen, argon, nitrogen, or helium. This material is hazardous through inhalation and produces local skin/eye impacts. Causes severe eye burns, central nervous system depression, and respiratory irritation with difficulty breathing (dyspnea) and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed.

Diborane is highly flammable and has an autoignition temperature of 125°F. It is also moisture sensitive and will ignite spontaneously in moist air at room temperature.

Used industrially as a catalyst for ethylene, styrene, butadiene, acrylic, and vinyl polymerizations; reducing agent in the synthesis of organic chemicals; for production of hard boron coatings on metals and ceramics; as a component or additive for high-energy fuels; and as a chemical intermediate in the synthesis of organic boron compounds and metal borohydrides. Use in the electronics industry to improve crystal growth, to impart electrical properties in pure crystals, and as a doping agent for p-type semiconductors.

This material is on the DHS Chemicals of Interest list and ITF-25 High Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 1.13 mg/m^3 at 77°F
$LC_{(Inh)}$: 180 mg/m^3 (159 ppm) for a 15-minute exposure
$MEG_{(1hr)}$: Neg: 0.13 ppm; Mar: 0.97 ppm; Crit: 3.7 ppm; Cat: —
PAC-1: 0.30 ppm; *PAC-2:* 0.97 ppm; *PAC-3:* 3.7 ppm
PEL: 0.1 ppm
REL: 0.1 ppm
TLV: 0.1 ppm
IDLH: 15 ppm

Final AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 1.0 ppm; 4 hr – 0.25 ppm; 8 hr – 0.13 ppm
AEGL-3: 1 hr – 3.7 ppm; 4 hr – 0.92 ppm; 8 hr – 0.46 ppm

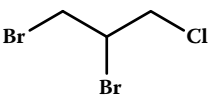
Properties:

MW: 27.7	*VP:* 30,000 mmHg (62°F)	*FlP:* –130°F
D: 0.31 g/mL (liq. gas, 14°F)	*VD:* 0.96	*LEL:* 0.9%
MP: –265°F	*Vlt:* NA	*UEL*: 98%
BP: –135°F	*ER:* 240	*RP:* NA
Vsc: 0.081 cS (liq. gas, 14°F)	*H_2O:* Reacts	*IP:* 11.38 eV
	Sol: Carbon disulfide, ammonium hydroxide	

C11-A053

1,2-Dibromo-3-chloropropane

CAS: 96-12-8
RTECS: TX8750000
UN: 2872; 159
EC: 202-479-3
UNII: 96K0FD4803
ICD-11: XM6PM8



$C_3H_5Br_2Cl$

Colorless dense liquid that may become yellow or amber on standing. Commercial material is amber to dark brown. It has a pungent odor at high concentrations. This material is hazardous through inhalation, skin absorption (liquid), penetration through broken skin, and ingestion, and produces local skin/eye impacts. Effects include central nervous system depression; causes skin, eye, and respiratory irritation with difficulty breathing (dyspnea) and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed.

Used industrially as an intermediate in organic synthesis and for production of retardants; and in agriculture as a soil fumigant.

Exposure Hazards

Conversion Factor: 1 ppm = 9.67 mg/m^3 at 77°F
Irritation: 0.2 ppm; exposure duration unspecified
MEG$_{(1hr)}$: Neg: 0.08 ppm; Mar: 0.52 ppm; Crit: 16 ppm; Cat: —
PAC-1: 0.0030 ppm; *PAC-2:* 2.2 ppm; *PAC-3:* 4.2 ppm
PEL: 0.001 ppm

Properties:

MW: 236.4	*VP:* 0.58 mmHg	*FlP:* 170°F
D: 2.1 g/mL	*VD:* 8.2	*LEL:* —
MP: 41°F	*Vlt:* 780 ppm	*UEL*: —
BP: 384°F (decomposes)	*ER:* —	*RP:* 11
Vsc: —	*H_2O:* 0.12%	*IP:* —
	Sol: Acetone, isopropyl alcohol, hydrocarbons	

C11-A054

Dichlorosilane

CAS: 4109-96-0
RTECS: VV3050000
UN: 2189; 119
EC: 223-888-3
UNII: —
ICD-11: —

H_2SiCl_2

Colorless gas with acrid biting odor that gives off white fumes in moist air. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts. Violent irritant; contact produces first- and second-degree burns, severe eye, and respiratory irritation with difficulty breathing (dyspnea) and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed.

Dichlorosilane is highly flammable and has an autoignition temperature of 136°F.

Used for the manufacture of electronic and photovoltaic components.

This material is on the DHS Chemicals of Interest list.

Exposure Hazards

Conversion Factor: 1 ppm = 4.13 mg/m^3 at 77°F
MEG$_{(1hr)}$: Neg: 0.90 ppm; Mar: 11 ppm; Crit: 51 ppm; Cat: —
PAC-1: 0.90 ppm; *PAC-2:* 11 ppm; *PAC-3:* 51 ppm

Final AEGLs
AEGL-1: 1 hr – 0.90 ppm; 4 hr – 0.90 ppm; 8 hr – 0.90 ppm
AEGL-2: 1 hr – 11 ppm; 4 hr – 5.5 ppm; 8 hr – 5.5 ppm
AEGL-3: 1 hr – 50 ppm; 4 hr – 13 ppm; 8 hr – 13 ppm

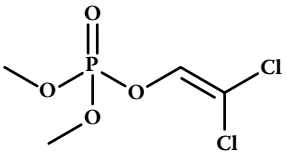
Properties:

MW: 101.0	*VP:* 1,227 mmHg	*FlP:* –35°F
D: 1.2 g/mL (liq. gas, 77°F)	*VD:* 3.5	*LEL:* 4.6%
MP: –188°F	*Vlt:* NA	*UEL*: 98%
BP: 46°F	*ER:* 290	*RP:* NA
Vsc: 0.15 cS (liq. gas, 77°F)	*H_2O:* Reacts	*IP:* 11.7 eV
	Sol: Ether, tetrahydrofuran, benzene	

C11-A055

Dichlorvos

CAS: 62-73-7
RTECS: TC0350000
UN: —
EC: 200-547-7
UNII: 7U370BPS14
ICD-11: XM03V8



C_4 H_7 Cl_2 O_4 P

Colorless to amber clear, dense liquid with a sweetish, aromatic odor. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. It is a cholinesterase inhibitor.

Used industrially as an insecticide.

This material is on the Australia Chemicals of Security Concern list.

This material has been used as a simulant for nerve agents in government tests.

Exposure Hazards

Conversion Factor: 1 ppm = 9.04 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.11 ppm; Mar: 0.56 ppm; Crit: 8.0 ppm; Cat: —
PAC-1: 0.20 ppm; *PAC-2:* 2.2 ppm; *PAC-3:* 22 ppm
PEL: 0.1 ppm [Skin]
REL: 0.1 ppm [Skin]
TLV: 0.01 ppm [Skin]
IDLH: 11 ppm [Skin]

Proposed AEGLs
AEGL-1: 1 hr – 0.11 ppm; 4 hr – 0.11 ppm; 8 hr – 0.11 ppm
AEGL-2: 1 hr – 0.56 ppm; 4 hr – 0.56 ppm; 8 hr – 0.56 ppm
AEGL-3: 1 hr – 8.0 ppm; 4 hr – 8.0 ppm; 8 hr – 8.0 ppm

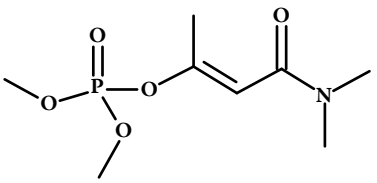
Properties:

MW: 221.0	*VP:* 0.0158 mmHg	*FlP:* 350°F
D: 1.4 g/mL	*VD:* 7.6	*LEL:* —
MP: —	*Vlt:* 21 ppm	*UEL*: —
BP: 453°F (decomposes)	*ER:* —	*RP:* 420
Vsc: —	*H_2O:* 0.8%	*IP:* 9.4 eV
	Sol: Chloroform, acetone	

C11-A056

Dicrotophos

CAS: 141-66-2
RTECS: TC3850000
UN: —
EC: 205-494-3
UNII: 205-494-3
ICD-11: XM5UL4



$C_8\ H_{16}\ N\ O_5\ P$

Colorless to amber liquid with a mild ester odor. Commercial material is brown. Mixture of the E and Z geometric isomers. Commercial material containing 85% E isomer, which is the active isomer. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. It is a cholinesterase inhibitor.

Used as an agricultural pesticide.

Exposure Hazards

Conversion Factor: 1 ppm = 9.70 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.15 mg/m^3; Mar: 0.29 mg/m^3; Crit: 0.88 mg/m^3; Cat: —
PAC-1: 0.15 mg/m^3; *PAC-2:* 0.90 mg/m^3; *PAC-3:* 17 mg/m^3
REL: 0.25 mg/m^3 [Skin]
TLV: 0.05 mg/m^3 [Skin]

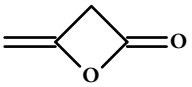
Proposed AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 0.29 mg/m^3; 4 hr – 0.073 mg/m^3; 8 hr – 0.037 mg/m^3
AEGL-3: 1 hr – 0.88 mg/m^3; 4 hr – 0.22 mg/m^3; 8 hr – 0.11 mg/m^3

Properties:

MW: 237.2	*VP:* 1.60×10^{-4} mmHg (77°F)	*FlP:* >200°F
D: 1.2 g/mL	*VD:* 8.2	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —

BP: 752°F	*ER:* —	*RP:* 64,000
Vsc: —	*H_2O:* Miscible	*IP:* —
	Sol: Acetone, alcohols, chloroform, xylene	

C11-A057
Diketene
CAS: 674-82-8
RTECS: RQ8225000
UN: 2521; 131P
EC: 211-617-1
UNII: 0DZ97C3Z7D
ICD-11: —



$C_4\ H_4\ O_2$

Clear, colorless to orange liquid with a pungent odor. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts. Contact produces first- and second-degree burns, severe eye irritation. Severe respiratory irritant with difficulty breathing (dyspnea).

Violent polymerization can occur in presence of acids, bases, or heat.

Used industrially as a chemical intermediate for pharmaceuticals, dyes, pigments and toners, food preservatives, insecticides, and fungicides.

This material is on the ITF-25 Medium Threat list.

Exposure Hazards
Conversion Factor: 1 ppm = 3.44 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 1.0 ppm; Mar: 6.1 ppm; Crit: 18 ppm; Cat: —
PAC-1: 0.090 ppm; *PAC-2:* 0.99 ppm; *PAC-3:* 2.9 ppm
IDLH: 7.6 ppm

Final AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 1.0 ppm; 4 hr – 0.25 ppm; 8 hr – 0.13 ppm
AEGL-3: 1 hr – 3.0 ppm; 4 hr – 0.75 ppm; 8 hr – 0.38 ppm

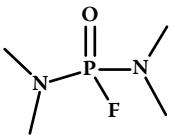
Properties:

MW: 84.1	*VP:* 8.03 mmHg	*FlP:* 93°F
D: 1.1 g/mL	*VD:* 2.9	*LEL:* —
MP: 20°F	*Vlt:* 11,000 ppm	*UEL*: —
BP: 262°F	*ER:* —	*RP:* 1.3
Vsc: 0.81 cS	*H_2O:* Reacts	*IP:* 9.6 eV
	Sol: Common organic solvents	

C11-A058

Dimefox

CAS: 115-26-4
RTECS: TD4025000
UN: —
EC: 204-076-8
UNII: N8RU9F1IQD
ICD-11: XM5Q52



C_4 H_{12} F N_2 O P

Colorless liquid with a fishy odor. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. It is a cholinesterase inhibitor.

Used as an agricultural pesticide.

Exposure Hazards

Conversion Factor: 1 ppm = 6.30 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.10 ppm; Mar: —; Crit: 0.16 ppm; Cat: —
PAC-1: 0.014 ppm; *PAC-2:* 0.16 ppm; *PAC-3:* 0.65 ppm

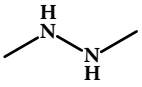
Properties:

MW: 154.1	*VP:* 0.11 mmHg	*FlP:* —
D: 1.1 g/mL	*VD:* 5.3	*LEL:* —
MP: 30°F (est.)	*Vlt:* 150 ppm	*UEL:* —
BP: 187°F (15 mmHg)	*ER:* —	*RP:* 73
Vsc: —	*H_2O:* Miscible	*IP:* —
	Sol: Most organic solvents	

C11-A059

1,2-Dimethylhydrazine

CAS: 540-73-8, 306-37-6 (Dihydrochloride salt)
RTECS: MV2625000
UN: 2382; 131
EC: 206-183-5 (Dihydrochloride salt)
UNII: IX068S9745; 8326154U0N (Dihydrochloride salt)
ICD-11: —



C_2 H_8 N_2

Mobile, hygroscopic clear, colorless liquid with a fishy, or ammonia-like odor that fumes in air. Slowly turns yellow after exposure to air. Various salts (solids) have been reported. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Causes severe skin, eye, and respiratory irritation with difficulty breathing (dyspnea) and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed. Can cause central nervous system depression.

Used industrially for research; as a boiler water treatment, and has seen limited use as a high-energy rocket fuel.

This material is on the ITF-25 Medium Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 2.46 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 1.6 ppm; Mar: 3.0 ppm; Crit: 11 ppm; Cat: —
PAC-1: 0.27 ppm; *PAC-2:* 3.0 ppm; *PAC-3:* 11 ppm

Final AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 3.0 ppm; 4 hr – 0.75 ppm; 8 hr – 0.38 ppm
AEGL-3: 1 hr – 11 ppm; 4 hr – 2.7 ppm; 8 hr – 1.4 ppm

Properties:

MW: 60.1	*VP:* 68 mmHg (77°F)	*FlP:* 73°F
D: 0.83 g/mL	*VD:* 2.1	*LEL:* 2.4%
MP: 16°F	*Vlt:* 89,000 ppm (77°F)	*UEL*: 20%
BP: 178°F	*ER:* 330	*RP:* 0.19
Vsc: —	*H_2O:* Miscible	*IP:* 9.02 eV
	Sol: Alcohol, ether, hydrocarbons	

C11-A060

Dimethylmercury
CAS: 593-74-8
RTECS: OW3010000
UN: —
EC: 209-805-3
UNII: C60TQU15XY
ICD-11: XM5DJ5



C_2 H_6 Hg

Colorless liquid with a faint, sweet odor. Odor threshold is not sufficient to provide good warning properties of exposure. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Easily absorbed through the skin. Causes mild skin, eye, and respiratory irritation. Severe neurotoxin producing incoordination (ataxia), weakness (asthenia), altered mental state with loss of contact with reality and delusions (psychosis), paralysis, coma and death. Symptoms may be delayed.

Used in organic synthesis.

This material is the Australia Chemicals of Security Concern list.

Exposure Hazards

Conversion Factor: 1 ppm = 9.44 mg/m^3 at 77°F
Skin: 0.1 mL dermal absorption can cause severe poisoning
MEG$_{(1hr)}$: Neg: 0.0040 ppm; Mar: 0.005 ppm; Crit: 0.24 ppm; Cat: —
PAC-1: 0.0036 ppm; *PAC-2:* 0.0049 ppm; *PAC-3:* 0.24 ppm

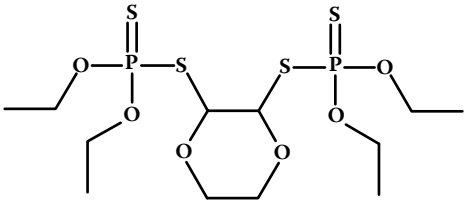
Properties:

MW: 230.7	*VP:* 62.3 mmHg (77°F)	*FlP:* 41°F
D: 3.0 g/mL (77°F)	*VD:* 8.0	*LEL:* —
MP: –45°F	*Vlt:* 82,000 ppm	*UEL:* —
BP: 199°F	*ER:* 320	*RP:* 0.11
Vsc: —	*H_2O:* 0.9%	*IP:* 9.10 eV
	Sol: —	

C11-A061

Dioxathion

CAS: 78-34-2
RTECS: TE3350000
UN: —
EC: 201-107-7
UNII: J2DF82JA7N
ICD-11: XM3494



C_{12} H_{26} O_6 P_2 S_4

Viscous, brown, tan, or dark-amber liquid. Commercial product is a mixture of cis and trans isomers. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. It is a cholinesterase inhibitor.

Used as an agricultural pesticide.

Exposure Hazards

Conversion Factor: 1 ppm = 18.67 mg/m^3 at 77°F
MEG$_{(1hr)}$: Neg: 0.30 mg/m^3; Mar: 3.4 mg/m^3; Crit: 150 mg/m^3; Cat: —
PAC-1: 0.31 mg/m^3; *PAC-2:* 3.4 mg/m^3; *PAC-3:* 39 mg/m^3
REL: 0.2 mg/m^3 [Skin]
TLV: 0.1 mg/m^3 [Skin]

Properties:

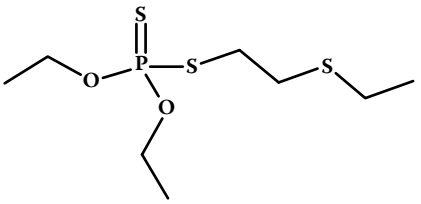
MW: 456.5	*VP:* 17.8 mmHg (77°F)	*FlP:* NA
D: 1.3 g/mL (79°F)	*VD:* 16	*LEL:* NA
MP: –4°F	*Vlt:* 23,000 ppm (77°F)	*UEL:* NA

BP: 140°F (0.5 mmHg)	*ER:* —	*RP:* 0.27
Vsc: 93 cS (77° F)	*H_2O:* Insoluble	*IP:* —
	Sol: Alcohols, ketones, aromatic hydrocarbons	

C11-A062

Disulfoton

CAS: 298-04-4
RTECS: TD9275000
UN: —
EC: 206-054-3
UNII: 3CY5EKL6MT
ICD-11: XM9SP5



$C_8\ H_{19}\ O_2\ P\ S_3$

Oily, colorless to yellow liquid with an aromatic sulfur odor. Commercial product is a yellow to brown liquid. This material is hazardous through inhalation, skin absorption, and ingestion, and produces local skin/eye impacts. It is a cholinesterase inhibitor.

Used industrially as an insecticide and acaricide.

This material is on the FBI list and Australia Chemicals of Security Concern list.

Exposure Hazards

Conversion Factor: 1 ppm = 11.22 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.15 mg/m^3; Mar: 2.0 mg/m^3; Crit: 75 mg/m^3; Cat: —
PAC-1: 0.18 mg/m^3; *PAC-2:* 2.0 mg/m^3; *PAC-3:* 8.8 mg/m^3
REL: 0.1 mg/m^3 [Skin]
TLV: 0.05 mg/m^3 [Skin]

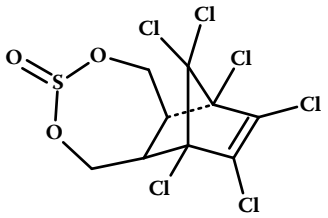
Properties:

MW: 274.4	*VP:* 1.8×10^{-4} mmHg	*FlP:* 271°F
D: 1.1 g/mL	*VD:* 9.5	*LEL:* —
MP: –13°F	*Vlt:* —	*UEL*: —
BP: 235°F (0.4 mmHg)	*ER:* —	*RP:* 33,000
Vsc: —	*H_2O:* 1.6×10^{-4}%	*IP:* 9.0 eV
	Sol: Most organic solvents	

C11-A063

Endosulfan

CAS: 115-29-7; 959-98-8 (α-Form); 33213-65-9 (β-Form)
RTECS: RB9275000; RB9275100 (α-Form); RB9875200 (β-Form)
UN: —
EC: 204-079-4
UNII: OKA6A6ZD4K; QY5Y9R7G0E (α-Form); TT768EVS2A (β-Form)
ICD-11: XM5C19



$C_9\ H_6\ Cl_6\ O_3\ S$

α-Endosulfan is the endo-, exo- isomer, referred to in the literature as endosulfan I. β-Endosulfan is the endo-, endo- isomer, referred to in the literature as endosulfan II.

Colorless crystalline material. Technical grade is typically brown, waxy flakes with a slight, sulfur dioxide odor. Commercial material is often shipped as a solution in an organic solvent. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Effects include central nervous system depression, difficulty breathing (dyspnea), blue skin and lips (cyanosis), and convulsions.

Used industrially as an insecticide, fungicide, herbicide and wood preservative.

This material is on the Australia Chemicals of Security Concern list and the NRL High Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 16.64 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.30 mg/m^3; Mar: 0.81 mg/m^3; Crit: 35 mg/m^3; Cat: —
PAC-1: 0.30 mg/m^3; *PAC-2:* 0.80 mg/m^3; *PAC-3:* 180 mg/m^3
REL: 0.1 mg/m^3 [Skin]
TLV: 0.1 mg/m^3 [Skin]

Properties:

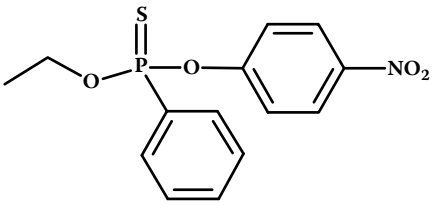
MW: 406.9	*VP:* 1.7×10^{-7} mmHg (77°F)	*FlP:* NA
D: 1.7 g/cm^3	*VD:* 14	*LEL:* NA
MP: 223°F	*Vlt:* —	*UEL*: NA
MP: 158°F–212°F (Commercial grade)	*ER:* —	*RP:* —
BP: Decomposes	*H_2O:* 5×10^{-5}% (77°F)	*IP:* —
Vsc: —	*Sol:* Acetone, ethyl acetate, toluene, kerosene, chloroform	

α-Form [959-98-8]	**β-Form [33213-65-9]**
MP: 226°F	*MP:* 406°F
H_2O: 5×10^{-5}% (77°F)	*H_2O:* 3×10^{-5}% (77°F)

C11-A064

EPN

CAS: 2104-64-5
RTECS: TB1925000
UN: —
EC: 218-276-8
UNII: 9Y6HP0HYA8
ICD-11: XM5BC5



C_{14} H_{14} N O_4 P S

White to light yellow crystalline solid or brown liquid with an aromatic odor. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. It is a cholinesterase inhibitor.

Used as an agricultural pesticide.

Exposure Hazards

Conversion Factor: 1 ppm = 13.22 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.50 mg/m^3; Mar: —; Crit: 5.0 mg/m^3; Cat: —
PAC-1: 0.45 mg/m^3; *PAC-2:* 5.0 mg/m^3; *PAC-3:* 50 mg/m^3
PEL: 0.5 mg/m^3 [Skin]
REL: 0.5 mg/m^3 [Skin]
TLV: 0.1 mg/m^3 [Skin]
IDLH: 5 mg/m^3 [Skin]

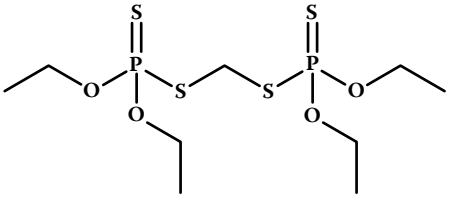
Properties:

MW: 323.3	*VP:* 9.5 × 10^{-7} mmHg	*FlP:* NA
D: 1.3 g/cm^3 (77° F)	*VD:* 11	*LEL:* NA
MP: 97°F	*Vlt:* —	*UEL*: NA
BP: 419°F (5 mmHg)	*ER:* —	*RP:* —
Vsc: —	*H_2O:* 3.1 × 10^{-4}%	*IP:* —
	Sol: Alcohols, ether, acetone, aromatic solvents	

C11-A065

Ethion

CAS: 563-12-2
RTECS: TE4550000
UN: —
EC: 209-242-3
UNII: 2TI07NO12Y
ICD-11: XM7X81



$C_9\ H_{22}\ O_4\ P_2\ S_4$

Colorless to amber-colored liquid. Pure material is odorless but technical product may have a very disagreeable odor. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. It is a cholinesterase inhibitor.

Used industrially as an insecticide and acaricide. Used as a cattle dip for ticks and treatment for buffalo flies.

This material is the Australia Chemicals of Security Concern list.

Exposure Hazards

Conversion Factor: 1 ppm = 15.73 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.15 mg/m^3; Mar: 13 mg/m^3; Crit: 350 mg/m^3; Cat: —
PAC-1: 1.2 mg/m^3; *PAC-2:* 13 mg/m^3; *PAC-3:* 38 mg/m^3
REL: 0.4 mg/m^3 [Skin]
TLV: 0.05 mg/m^3 [Skin]

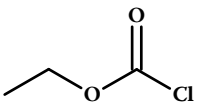
Properties:

MW: 384.5	*VP:* 1.5×10^{-6} mmHg (77°F)	*FlP:* 349°F
D: 1.2 g/mL	*VD:* 13	*LEL:* —
MP: 19°F	*Vlt:* —	*UEL:* —
MP: 10°F Technical grade	*ER:* —	*RP:* —
BP: Decomposes	*H_2O:* 2×10^{-4}%	*IP:* —
Vsc: —	*Sol:* Most organic solvents	

C11-A066

Ethyl Chloroformate

CAS: 541-41-3
RTECS: LQ6125000
UN: 1182; 155
EC: 208-778-5
UNII: 09601EZP9R
ICD-11: —



$C_3\ H_5\ Cl\ O_2$

Clear, water-white liquid with an irritating, sharp odor like hydrogen chloride. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts. Violent irritant; contact produces first- and second-degree burns, severe eye, and respiratory irritation with difficulty breathing (dyspnea) and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed.

Used in the production of carbamates that are used to synthesis dyes, drugs, veterinary medicines, herbicides and insecticides; as a solvent in the photographic industry; used as a stabilizer for PVC.

This material is on the ITF-25 Low Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 4.44 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.90 ppm; Mar: 1.6 ppm; Crit: 4.7 ppm; Cat: —
PAC-1: 0.15 ppm; *PAC-2:* 1.6 ppm; *PAC-3:* 4.7 ppm

Final AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 1.6 ppm; 4 hr – 0.40 ppm; 8 hr – 0.20 ppm
AEGL-3: 1 hr – 4.8 ppm; 4 hr – 1.2 ppm; 8 hr – 0.60 ppm

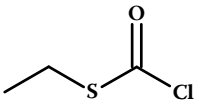
Properties:

MW: 108.5	*VP:* 22.4 mmHg (77°F)	*FlP:* 61°F
D: 1.1 g/mL	*VD:* 3.7	*LEL:* 3.5%
MP: –113°F	*Vlt:* 29,000 ppm (77°F)	*UEL*: 10.2%
BP: 200°F	*ER:* —	*RP:* 0.43
Vsc: 2.8 cS	*H_2O:* Insoluble (decomposes slowly)	*IP:* —
	Sol: Alcohol, benzene, ether	

C11-A067

Ethyl Chlorothioformate

CAS: 2941-64-2
RTECS: FG3855000
UN: 2826; 155
EC: 220-928-1
UNII: 8B294Z76EO
ICD-11: —



C_3 H_5 Cl O S

Clear colorless liquid with a foul stench. Colors of commercial material vary depending on the impurities present and range from grey to green to yellow to purple. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts. Violent irritant; contact produces first- and second-degree burns, severe eye and respiratory irritation with central nervous system depression.

This material is on the ITF-25 Low Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 5.10 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.15 ppm; Mar: 0.25 ppm; Crit: 0.78 ppm; Cat: —
PAC-1: 0.025 ppm; *PAC-2:* 0.27 ppm; *PAC-3:* 0.84 ppm

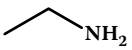
Final AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 0.26 ppm; 4 hr – 0.17 ppm; 8 hr – 0.083 ppm
AEGL-3: 1 hr – 0.79 ppm; 4 hr – 0.50 ppm; 8 hr – 0.25 ppm

Properties:

MW: 124.6	*VP:* 8.3 mmHg (70°F)	*FlP:* 86°F
D: 1.2 g/mL	*VD:* 4.3	*LEL:* —
MP: –76°F	*Vlt:* 11,000 ppm (70°F)	*UEL*: —
BP: 270°F	*ER:* —	*RP:* 1.1
Vsc: 2.5 cS	*H_2O:* <0.1% (decomposes slowly)	*IP:* —
	Sol: —	

C11-A068

Ethylamine
CAS: 75-04-7
RTECS: KH2100000
UN: 1036; 118
EC: 200-834-7
UNII: YG6MGA6AT5
ICD-11: XM9B27



C_2 H_7 N

Hygroscopic, colorless gas or water-white liquid with a fishy or ammonia-like odor that is detectable at ≥0.74 ppm. Various salts (solids) have been reported. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Causes irritation of the skin, eyes and respiratory system with difficulty breathing (dyspnea).

Used industrially as a stabilizer for rubber latex; intermediate for dyestuffs and medicinals; in oil refining; production of the herbicides of the triazine type; in organic syntheses; flavor enhancer/stabilizer in baked goods, dairy, and meat products; and as a precursor chemical in clandestine drug syntheses.

This material is on the NRL Critical Threat list.

Exposure Hazards
Conversion Factor: 1 ppm = 1.84 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 7.6 ppm; Mar: 49 ppm; Crit: 270 ppm; Cat: —
PAC-1: 7.6 ppm; *PAC-2:* 49 ppm; *PAC-3:* 270 ppm
PEL: 10 ppm
REL: 10 ppm
TLV: 5 ppm [Skin]
$STEL_{(ACGIH)}$: 15 ppm [Skin]
IDLH: 600 ppm

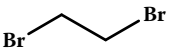
Interim AEGLs
AEGL-1: 1 hr – 7.5 ppm; 4 hr – 7.5 ppm; 8 hr – 7.5 ppm
AEGL-2: 1 hr – 49 ppm; 4 hr – 22 ppm; 8 hr – 14 ppm
AEGL-3: 1 hr – 270 ppm; 4 hr – 120 ppm; 8 hr – 76 ppm

Properties:

MW: 45.1	*VP:* 907.6 mmHg	*FlP:* –35°F
D: 0.68 g/mL (68°F)	*VD:* 1.6	*LEL:* 3.5%
MP: –114°F	*Vlt:* NA	*UEL*: 14%
BP: 62°F	*ER:* 360	*RP:* NA
Vsc: 1.2 cS (86°F)	*H_2O:* Miscible	*IP:* 8.86 eV
	Sol: Miscible in ethanol, ether	

C11-A069

Ethylene Dibromide
CAS: 106-93-4
RTECS: KH9275000
UN: 1605; 154
EC: 203-444-5
UNII: 1N41638RNO
ICD-11: XM9GK3



C_2 H_4 Br_2

Colorless heavy liquid with a mild, sweet odor like chloroform that is detectible at ≤10 ppm. Turns brown with exposure to light due to decomposition. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Contact produces pain with blisters (vesiculation), severe eye and respiratory irritation with difficulty breathing (dyspnea) and central nervous system depression. Symptoms may be delayed.

Used industrially as a chemical intermediate in the manufacture of dyes, pharmaceuticals, and polymers; as a special solvent, as an exhaust system scavenger for leaded fuels, and in gauge fluids; used in agriculture as a fumigant

This material is on the ITF-25 Medium Threat lists and NRL Critical Threat list.

Exposure Hazards
Conversion Factor: 1 ppm = 7.69 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 17 ppm; Mar: 23 ppm; Crit: 46 ppm; Cat: —
PAC-1: 17 ppm; *PAC-2:* 23 ppm; *PAC-3:* 46 ppm
PEL: 20 ppm
REL: 0.045 ppm
$Ceiling_{(OSHA)}$: 30 ppm
$Ceiling_{(NIOSH)}$: 0.13 ppm
IDLH: 100 ppm

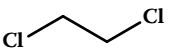
Interim AEGLs
AEGL-1: 1 hr – 17 ppm; 4 hr – 7.1 ppm; 8 hr – 4.6 ppm
AEGL-2: 1 hr – 24 ppm; 4 hr – 10 ppm; 8 hr – 6.5 ppm
AEGL-3: 1 hr – 46 ppm; 4 hr – 17 ppm; 8 hr – 10 ppm

Properties:

MW: 187.9	*VP:* 8.5 mmHg	*FlP:* NA
D: 2.2 g/mL	*VP:* 11.2 mmHg (77°F)	*LEL:* NA
MP: 50°F	*VD:* 6.5	*UEL*: NA
BP: 268°F	*Vlt:* 15,000 ppm	*RP:* 0.66
Vsc: 0.80 cS	*ER:* —	*IP:* 9.45 eV
	H_2O: 0.4%	
	Sol: Most organic solvents	

C11-A070

Ethylene Dichloride
CAS: 107-06-2
RTECS: KI0525000
UN: 1184; 131
EC: 203-458-1
UNII: WD06X94M2D
ICD-11: XM8QX0; XM4Z80 (Liquid)



$C_2 H_4 Cl_2$

Clear, colorless oily liquid that darkens on storage due to decomposition. It has a pleasant, sweet odor similar to chloroform. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Causes skin, eye, and respiratory irritation with difficulty breathing (dyspnea) and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed. Produces central nervous system depression.

Used industrially as a solvent, for the production of various halogenated materials including vinyl chloride, trichloroethylene, and trichloroethane, in the manufacture of soaps, scouring compounds, wetting agents, penetrating agents, for ore flotation and in organic synthesis. Also used as a fumigant.

Exposure Hazards
Conversion Factor: 1 ppm = 4.05 mg/m^3 at 77°F
MEG$_{(1hr)}$: Neg: 49 ppm; Mar: 200 ppm; Crit: 300 ppm; Cat: —
PAC-1: 49 ppm; *PAC-2:* 200 ppm; *PAC-3:* 300 ppm
PEL: 50 ppm
REL: 1 ppm
TLV: 10 ppm
STEL$_{(NIOSH)}$: 2 ppm
Ceiling$_{(OSHA)}$: 100 ppm
IDLH: 50 ppm

Properties:

MW: 99.0	*VP:* 78.9 mmHg (77°F)	*FlP:* 56°F
D: 1.2 g/mL	*VD:* 3.4	*LEL:* 6.2%
MP: –32°F	*Vlt:* 86,000 ppm	*UEL*: 16%
BP: 182°F	*ER:* 290	*RP:* 0.16
Vsc: 0.68 cS	*H_2O:* 0.87%	*IP:* 11.05 eV
	Sol: Most organic solvents	

C11-A071

Ethylene Oxide

CAS: 75-21-8
RTECS: KX2450000
UN: 1040; 119P
EC: 200-849-9
UNII: JJH7GNN18P
ICD-11: XM4G15 (Fumigant); XD9557 (Sterilizer); XM09B1 (Medicinal)



$C_2 H_4 O$

Colorless gas or liquid with an odor like ether detectable above ≥50 ppm. The odor has also been described as sweet and reminiscent of bruised apples. Industrially, it can be found diluted with a variety of gases including carbon dioxide, fluorocarbons, and nitrogen. This material is hazardous through inhalation, skin absorption, and ingestion (liquid), and produces local skin/eye impacts. Causes severe skin, eye, and respiratory irritation with difficulty breathing (dyspnea), blue skin and lips (cyanosis), and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed. Causes central nervous system depression.

Used industrially as a fumigant for foodstuffs and textiles, sterilizing agent for surgical instruments and other heat sensitive material, agricultural fungicide, ripening agent for fruits, rocket propellant; in the manufacture of acrylonitrile, ethylene glycol, dioxane, ethylene chlorohydrin, ethanolamines, glycol ethers, carbowax, the cellosolves and carbitols, polyethylene terephthalate polyester fiber, and nonionic surfactants.

This material is on the DHS Chemicals of Interest list and ITF-25 High Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 1.80 mg/m^3 at 77°F

Lethal human toxicity values have not been established or have not been published. However, symptoms of illness occur at 100 ppm (exposure duration unspecified) and severe toxic effects have been reported at concentrations of 250 ppm for a 60-minute exposure. Concentrations of 500 ppm for ≤3 minutes have produced rapid onset of central nervous system effects.

$MEG_{(1hr)}$: Neg: 5 ppm; Mar: 45 ppm; Crit: 200 ppm; Cat: —
PAC-1: 5 ppm; *PAC-2:* 45 ppm; *PAC-3:* 200 ppm
PEL: 1 ppm
REL: <0.1 ppm
TLV: 1 ppm [Skin]

Ceiling$_{(NIOSH)}$: 5 ppm
Excursion$_{(OSHA)}$: 5 ppm (15-minuite limit)
IDLH: 800 ppm

Final AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 45 ppm; 4 hr – 14 ppm; 8 hr – 7.9 ppm
AEGL-3: 1 hr – 200 ppm; 4 hr – 63 ppm; 8 hr – 35 ppm

Properties:

MW: 44.1	*VP:* 1,314 mmHg (77°F)	*FlP:* –67°F
D: 0.86 g/mL (liq. gas, 77°F)	*VD:* 1.5	*LEL:* 3%
MP: –168°F	*Vlt:* NA	*UEL*: 100%
BP: 51°F	*ER:* 480	*RP:* NA
Vsc: 0.30 cS (liq. gas, 77°F)	*H_2O:* Miscible	*IP:* 10.56 eV
	Sol: Most organic solvents	

C11-A072

Ethyleneimine
CAS: 151-56-4
RTECS: KX5075000
UN: 1185; 131P
EC: 205-793-9
UNII: 54P5FEX9FH
ICD-11: XM3GN3



$C_2 H_5 N$

Mobile, colorless liquid with an odor like ammonia that is detectable at ≥2 ppm. The odor becomes annoying at 11 ppm. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Contact produces first- and second-degree burns, severe eye irritation. Severe respiratory irritation with difficulty breathing (dyspnea) and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed. Causes central nervous system depression. Dermal exposure causes skin sensitization.

Used industrially in the manufacture of pharmaceuticals, textile chemicals, adhesives, binders, petroleum refining chemicals, fuels, lubricants, coating resins, varnishes, polymerizations, lacquers, agricultural chemicals, cosmetics, ion exchange resins, photographic chemicals, surfactants; used in the paper industry and as a flocculation aid.

This material is on the ITF-25 Low Threat list.

Exposure Hazards
Conversion Factor: 1 ppm = 1.76 mg/m^3 at 77°F
Irritation: 100 ppm; exposure duration unspecified
MEG$_{(1hr)}$: Neg: 0.085 ppm; Mar: 4.6 ppm; Crit: 9.7 ppm; Cat: —
PAC-1: 0.10 ppm; *PAC-2:* 4.6 ppm; *PAC-3:* 9.7 ppm
TLV: 0.05 ppm [Skin]

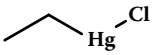
$STEL_{(ACGIH)}$: 0.1 ppm [Skin]
IDLH: 100 ppm

Final AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 4.6 ppm; 4 hr – 1.0 ppm; 8 hr – 0.47 ppm
AEGL-3: 1 hr – 9.9 ppm; 4 hr – 2.8 ppm; 8 hr – 1.5 ppm

Properties:

MW: 43.1	*VP:* 160 mmHg	*FlP:* 12°F
D: 0.83 g/mL	*VD:* 1.5	*LEL:* 3.3%
MP: –97°F	*Vlt:* 210,000 ppm	*UEL*: 54.8%
BP: 133°F	*ER:* 460	*RP:* 0.095
Vsc: —	*H_2O:* Miscible	*IP:* 9.20 eV
	Sol: Alcohol, ether, benzene	

C11-A073
Ethylmercury Chloride
CAS: 107-27-7
RTECS: OV9800000
UN: —
EC: 203-478-0
UNII: M04218TP6P
ICD-11: XM8JX9



C_2 H_5 Cl Hg

Silver crystals or white fluffy solid that sublimes readily and is sensitive to light. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Causes severe skin, eye, and respiratory irritation; may produce burns. Neurotoxin producing incoordination (ataxia), weakness (asthenia), altered mental state, convulsions, and coma.

Used industrially as a fungicide

This material is on the Australia Chemicals of Security Concern list.

Exposure Hazards
Conversion Factor: 1 ppm = 10.84 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.040 mg/m^3; Mar: 0.053 mg/m^3; Crit: 2.6 mg/m^3; Cat: —
PAC-1: 0.040 mg/m^3; *PAC-2:* 0.53 mg/m^3; *PAC-3:* 2.6 mg/m^3

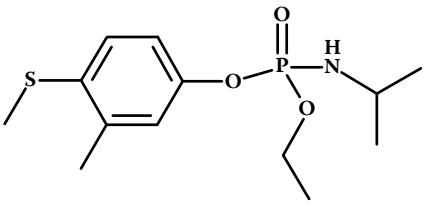
Properties:

MW: 265.1	*VP:* 0.075 mmHg (77°F)	*FlP:* —
D: 3.5 g/cm^3	*VD:* 9.1	*LEL:* —
MP: 378°F	*Vlt:* 99 ppm	*UEL*: —
BP: Sublimes	*ER:* —	*RP:* 83
Vsc: —	*H_2O:* 2 × 10^{-4}%	*IP:* 10.22 eV
	Sol: —	

C11-A074

Fenamiphos

CAS: 22224-92-6
RTECS: TB3675000
UN: —
EC: 244-848-1
UNII: H4NO3L2HBE
ICD-11: —



C_{13} H_{22} N O_3 P S

Colorless crystals, or off-white to tan, waxy solid. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. It is a cholinesterase inhibitor.

Used as an agricultural nematicide and insecticide.

This material is on the DHS Chemicals of Interest list and NRL Critical Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 12.41 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.15 mg/m^3; Mar: 0.70 mg/m^3; Crit: 2.1 mg/m^3; Cat: —
PAC-1: 0.15 mg/m^3; *PAC-2:* 0.90 mg/m^3; *PAC-3:* 3.1 mg/m^3
REL: 0.1 mg/m^3 [Skin]
TLV: 0.05 mg/m^3 [Skin]

Proposed AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 0.70 mg/m^3; 4 hr – 0.53 mg/m^3; 8 hr – 0.43 mg/m^3
AEGL-3: 1 hr – 2.1 mg/m^3; 4 hr – 1.6 mg/m^3; 8 hr – 1.3 mg/m^3

Properties:

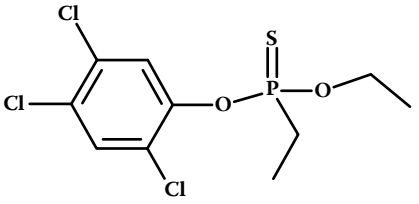
MW: 303.4	*VP:* 9 × 10^{-6} mmHg	*FlP:* 212°F
D: 1.2 g/cm^3 (73° F)	*VD:* —	*LEL:* —
MP: 121°F	*Vlt:* —	*UEL:* —
BP: —	*ER:* —	*RP:* —
Vsc: —	*H_2O:* 0.033%	*IP:* —
	Sol: Dichloromethane, isopropanol, toluene	

C11-A075

Fenophosphon

CAS: 327-98-0
RTECS: TB0700000
UN: —

EC: 206-326-1
UNII: 55228MJ5QM
ICD-11: —



C_{10} H_{12} Cl_3 O_2 P S

Amber colored liquid. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. It is a cholinesterase inhibitor.

Used as an agricultural insecticide.

This material is on Schedule 2 of the CWC.

Exposure Hazards

Conversion Factor: 1 ppm = 13.64 mg/m^3 at 77°F
PAC-1: 0.91 mg/m^3; *PAC-2:* 10 mg/m^3; *PAC-3:* 30 mg/m^3

Properties:

MW: 333.6	*VP:* 1.5×10^{-5} mmHg	*FlP:* —
D: 1.4 g/mL	*VD:* 12	*LEL:* —
MP: —	*Vlt:* —	*UEL*: —
BP: 226°F (0.01 mmHg)	*ER:* —	*RP:* —
Vsc: —	*H_2O:* 5.9×10^{-5}%	*IP:* —
	Sol: Acetone, alcohols, kerosene	

C11-A076

Fluorine

CAS: 7782-41-4
RTECS: LM6475000
UN: 1045; 9192 (Cryogenic liquid); 124
EC: 231-954-8
UNII: 284SYP0193
ICD-11: XM9SB2

F_2

Pale-yellow to greenish gas with a pungent, irritating odor detectable at ≥0.14 ppm. Spontaneously combusts most organic materials; reacts with most metals. This material is hazardous through inhalation, and produces local skin/eye impacts. Contact produces first- and second-degree burns, severe eye and respiratory irritation with difficulty breathing (dyspnea) and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed.

Used industrially in the manufacture of fluorocarbons and other fluorinated materials, and as a rocket propellant.

This material is on the DHS Chemicals of Interest list, Australia Chemicals of Security Concern list, ITF-25 High Threat list, and NRL Critical Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 1.55 mg/m^3 at 77°F
Eye Irritation: 25 ppm for a 5-minute exposure
MEG$_{(1hr)}$: Neg: 1.7 ppm; Mar: 5.0 ppm; Crit: 13 ppm; Cat: —
PAC-1: 1.7 ppm; *PAC-2:* 5.0 ppm; *PAC-3:* 13 ppm
PEL: 0.1 ppm
REL: 0.1 ppm
TLV: 0.1 ppm
Ceiling$_{(ACGIH)}$: 0.5 ppm
IDLH: 25 ppm

Final AEGLs
AEGL-1: 1 hr – 1.7 ppm; 4 hr – 1.7 ppm; 8 hr – 1.7 ppm
AEGL-2: 1 hr – 5.0 ppm; 4 hr – 2.3 ppm; 8 hr – 2.3 ppm
AEGL-3: 1 hr – 13 ppm; 4 hr – 5.7 ppm; 8 hr – 5.7 ppm

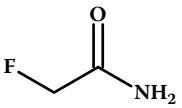
Properties:

MW: 38.0	*VP:* 5 × 10^6 mmHg (est.)	*FlP:* NA
D: 1.3 g/mL (liq. gas, –256°F)	*VD:* 1.3	*LEL:* NA
MP: –363°F	*Vlt:* NA	*UEL*: NA
BP: –307°F	*ER:* 470	*RP:* NA
Vsc: 0.084 cS (liq. gas, –238°F)	*H_2O:* Reacts	*IP:* 15.70 eV
	Sol: —	

C11-A077

Fluoroacetamide

CAS: 640-19-7
RTECS: AC1225000
UN: —
EC: 211-363-1
UNII: B18R611M38
ICD-11: XM7P90



C_2 H_4 F N O

Colorless to white crystalline powder. This material is hazardous through inhalation, skin absorption, and penetration through broken skin. Effects include nausea, blue skin and lips (cyanosis), irregular heartbeat (cardiac arrhythmias), and convulsions. Symptoms may be delayed.

Used industrially as a rodenticide and insecticide.

Exposure Hazards

Conversion Factor: 1 ppm = 3.15 mg/m^3 at 77°F
MEG$_{(1hr)}$: Neg: 3.5 mg/m^3; Mar: —; Crit: 5.8 mg/m^3; Cat: —
PAC-1: 0.53 mg/m^3; *PAC-2:* 5.8 mg/m^3; *PAC-3:* 19 mg/m^3

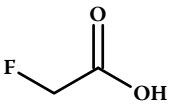
Properties:

MW: 77.1	*VP:* 0.15 mmHg (77°F)	*FlP:* 230°F
D: 1.1 g/cm^3	*VD:* 2.7	*LEL:* —
MP: 226°F	*Vlt:* 200 ppm	*UEL*: —
BP: 498°F (Sublimes)	*ER:* —	*RP:* 77
Vsc: —	*H$_2$O:* Soluble	*IP:* —
	Sol: Acetone, ethanol	

C11-A078

Fluoroacetic Acid

CAS: 144-49-0
RTECS: AH5950000
UN: 2642; 154
EC: 205-631-7
UNII: AP1JV9U41M
ICD-11: —



C_2 H_3 F O_2

Colorless crystalline material that is odorless. Various salts (solids) have been reported (see Sodium fluoroacetate C11-A152). This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Contact produces first- and second-degree burns. Effects include difficulty breathing (dyspnea), blue skin and lips (cyanosis), irregular heartbeat (cardiac arrhythmias), and convulsions. Symptoms may be delayed. Used industrially as a rodenticide and chemical intermediate. Occurs naturally in over 40 plant species.

This material is on the Australia Chemicals of Security Concern list.

Exposure Hazards

Conversion Factor: 1 ppm = 3.19 mg/m^3 at 77°F
LD$_{50}$: 0.14 – 0.7 g; exposure route unspecified
MEG$_{(1hr)}$: Neg: 0.78 ppm; Mar: 0.15 ppm; Crit: 0.63 ppm; Cat: —
PAC-1: 0.013 ppm; *PAC-2:* 0.15 ppm; *PAC-3:* 0.29 ppm

Properties:

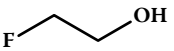
MW: 78.0	*VP:* 0.828 mmHg (77°F)	*FlP:* 132°F
D: 1.4 g/cm^3	*VD:* 2.7	*LEL:* —
MP: 95°F	*Vlt:* 1,000 ppm (77°F)	*UEL*: —

BP: 329°F	*ER:* —	*RP:* 14
Vsc: —	*H_2O:* Miscible	*IP:* —
	Sol: Ethanol, DMSO	

C11-A079

Fluoroethyl Alcohol

CAS: 371-62-0
RTECS: KL1575000
UN: —
EC: 206-740-2
UNII: 4M427A5HML
ICD-11: —



C_2 H_5 F O

Clear, colorless liquid. Various salts (solids) have been reported. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion. Converted to Fluoroacetic acid (C11-A078) in the body. Effects include difficulty breathing (dyspnea), blue skin and lips (cyanosis), irregular heartbeat (cardiac arrhythmias), and convulsions. Symptoms may be delayed.

Used industrially as a rodenticide; insecticide and acaricide.

This material is on the Australia Chemicals of Security Concern list.

Exposure Hazards

Conversion Factor: 1 ppm = 2.62 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.013 ppm; Mar: 0.023 ppm; Crit: 1.3 ppm; Cat: —
PAC-1: 0.0024 ppm; *PAC-2:* 0.027 ppm; *PAC-3:* 0.35 ppm

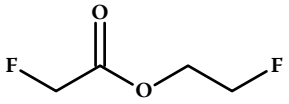
Properties:

MW: 64.1	*VP:* 21.25 mmHg (77°F)	*FlP:* 93°F
D: 1.1 g/mL	*VD:* 2.2	*LEL:* —
MP: –16°F	*Vlt:* 21,000 ppm	*UEL*: —
BP: 217°F	*ER:* —	*RP:* 0.78
Vsc: —	*H_2O:* Miscible	*IP:* 10.66 eV
	Sol: Miscible in ethanol, ethyl ether. Soluble in acetone.	

C11-A080

2-Fluoroethyl Fluoroacetate

CAS: 459-99-4
RTECS: —
UN: —
EC: —
UNII: —
ICD-11: —



$C_4\ H_6\ F_2\ O_2$

Specific information is not available for this material. This material is potentially hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and may produce local skin/eye impacts. Effects may include difficulty breathing (dyspnea), blue skin and lips (cyanosis), irregular heartbeat (cardiac arrhythmias), and convulsions. Symptoms may be delayed.

Used industrially as a pesticide. Proposed as a component of a nonaqueous solvent for batteries. This material is on the Australia Chemicals of Security Concern list.

Exposure Hazards

Conversion Factor: 1 ppm = 5.08 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published. However, based on available information, this agent appears to be approximately twice as toxic Methyl fluoroacetate (C11-A114).

Properties:

MW: 124.1	*VP:* 60 mmHg (est.)	*FlP:* 28°F (est.)
D: 1.2 g/mL	*VD:* 4.3	*LEL:* —
MP: −56°F (est.)	*Vlt:* —	*UEL*: —
BP: 235°F (est.)	*ER:* —	*RP:* 0.2 (est.)
Vsc: 0.7 cS (est.)	*H_2O:* 3% (est.)	*IP:* —
	Sol: —	

C11-A081

Fluorotrichloromethane

CAS: 75-69-4
RTECS: PB6125000
UN: —
EC: 200-892-3
UNII: 990TYB331R
ICD-11: XM7FF5

CCl_3F

Colorless to water-white liquid or gas that is nearly odorless. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Effects include central nervous system depression, incoordination (ataxia), irregular heartbeat (cardiac arrhythmias), and difficulty breathing (dyspnea).

Used industrially as a refrigerant, dielectric fluid, solvent, and aerosol propellant.

This material is on the NRL Critical Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 5.62 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 890 ppm; Mar: 1,300 ppm; Crit: 1,800 ppm; Cat: —
PAC-1: 91 ppm; *PAC-2:* 1,000 ppm; *PAC-3:* 10,000 ppm
PEL: 1,000 ppm
$Ceiling_{(ACGIH)}$: 1,000 ppm

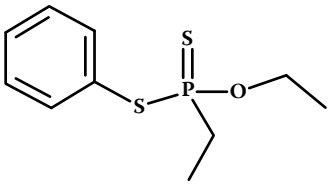
Ceiling$_{(NIOSH)}$: 1,000 ppm
IDLH: 2,000 ppm

Properties:

MW: 137.4	*VP:* 636 mmHg (70°F)	*FlP:* NA
D: 1.5 g/mL (70°F)	*VD:* 4.7	*LEL:* NA
MP: –167°F	*Vlt:* 1,000,000 ppm	*UEL*: NA
BP: 75°F	*ER:* 260	*RP:* 0.01
Vsc: 0.29 cS	*H_2O:* 0.13%	*IP:* 11.68 eV
	Sol: Most organic solvents	

C11-A082

Fonofos
CAS: 944-22-9
RTECS: TA5950000
UN: —
EC: 213-408-0
UNII: P4VT8081QO
ICD-11: —



C_{10} H_{15} O P S_2

Clear colorless to light-yellow liquid with an aromatic; pungent skunk-like odor. This material is hazardous through inhalation, skin absorption, and ingestion, and produces local skin/eye impacts. It is a cholinesterase inhibitor.

Used industrially as a soil fumigant.

This material is on the FBI threat list.

Exposure Hazards
Conversion Factor: 1 ppm = 10.07 mg/m^3 at 77°F
MEG$_{(1hr)}$: Neg: 0.30 mg/m^3; Mar: 1.3 mg/m^3; Crit: 200 mg/m^3; Cat: —
PAC-1: 0.30 mg/m^3; *PAC-2:* 1.3 mg/m^3; *PAC-3:* 53 mg/m^3
REL: 0.1 mg/m^3 [Skin]
TLV: 0.1 mg/m^3 [Skin]

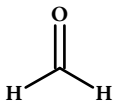
Properties:

MW: 246.3	*VP:* 2.1 × 10^{-4} mmHg (77°F)	*FlP:* 354°F
D: 1.2 g/cm^3	*VD:* 8.5	*LEL:* —
MP: 90°F	*Vlt:* —	*UEL*: —
BP: 266°F (0.1 mmHg)	*ER:* —	*RP:* 19,000
Vsc: —	*H_2O:* 0.0016%	*IP:* —
	Sol: Most organic solvents	

C11-A083

Formaldehyde

CAS: 50-00-0; 30525-89-4 (Paraformaldehyde)
RTECS: LP8925000; RV0540000 (Paraformaldehyde)
UN: 2213; 133 (Paraformaldehyde)
EC: 200-001-8; 608-494-5 (Paraformaldehyde)
UNII: 1HG84L3525; Y19UC83H8E (Paraformaldehyde)
ICD-11: XM0TV9



$C H_2 O$

Nearly colorless gas with a pungent, suffocating odor detectable at ≥1 ppm. Gas is typically shipped as a solution in methanol or water, which are colorless to light yellow. The solid paraformaldehyde is a white powder, granules, or flakes. This material is hazardous through inhalation, skin absorption of solutions, ingestion of solutions or solids, and produces local skin/eye impacts. Causes skin, eye, and respiratory irritation with tearing (lacrimation), difficulty breathing (dyspnea) and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed.

Used industrially to manufacture of amino and phenolic resins, fertilizers; as a nickel-plating brightening agent, reducing agent in the recovery of gold and silver, latex coagulant, crease-proof textile finishing agent, photographic gelatin hardening agent, taxidermy preservative, cross linking agent, corrosion inhibitor, hydrogen sulfide scavenger, industrial sterilant, preservative, and biocide. Used medically as an ingredient in embalming fluids, as a fixative of histological specimens, and to alter bacterial toxins to toxoids for vaccines.

This material is on the DHS Chemicals of Interest list, ITF-25 High Threat list, and NRL High Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 1.23 mg/m^3 at 77°F
Eye Irritation: 4 ppm; exposure duration unspecified
$MEG_{(1hr)}$*:* Neg: 0.89 ppm; Mar: 14 ppm; Crit: 56 ppm; Cat: —
PAC-1: 0.89 ppm; *PAC-2:* 14 ppm; *PAC-3:* 56 ppm
PEL: 0.75 ppm
REL: 0.016 ppm
TLV: 0.1 ppm
$STEL_{(OSHA)}$*:* 2 ppm
$STEL_{(ACGIH)}$*:* 0.3 ppm
$Ceiling_{(NIOSH)}$*:* 0.1 ppm
IDLH: 20 ppm

Interim AEGLs
AEGL-1: 1 hr – 0.9 ppm; 4 hr – 0.9 ppm; 8 hr – 0.9 ppm
AEGL-2: 1 hr – 14 ppm; 4 hr – 14 ppm; 8 hr – 14 ppm
AEGL-3: 1 hr – 56 ppm; 4 hr – 35 ppm; 8 hr – 35 ppm

Properties:

MW: 30.0	*VP:* 3,890 mmHg (77°F)	*FlP:* —
D: —	*VD:* 1.1	*LEL:* 7.0%

MP: –134°F	*Vlt:* —	*UEL*: 73%
BP: –3.1°F	*ER:* —	*RP:* NA
Vsc: —	*H_2O:* 40%	*IP:* 10.88 eV
	Sol: Alcohols, ether, acetone, benzene	

Paraformaldehyde:

MW: Polymer	*VP:* 10.5 mmHg (77°F)	*FlP:* 158°F
D: 1.5 g/cm^3 (59°F)	*VD:* 1.1	*LEL:* 7%
MP: 327°F (decomposes)	*Vlt:* —	*UEL*: 73%
BP: 248°F (sublimes)	*ER:* —	*RP:* —
Vsc: —	*H_2O:* Insoluble	*IP:* 10.88 eV
	Sol: Insoluble in most organic solvents	

C11-A084

Germanium Tetrafluoride

CAS: 7783-58-6
RTECS: —
UN: —
EC: 232-011-3
UNII: X83T8V2NRK
ICD-11: —

GeF_4

Colorless gas that forms white fumes in humid air with a pungent, garlic-like odor. However, odor is subjective and inadequate to warn of over exposure. This material is hazardous through inhalation, and produces local skin/eye impacts. Violent irritant; contact produces first- and second-degree burns, severe eye, and respiratory irritation with difficulty breathing (dyspnea) and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed.
Used industrially for semiconductor manufacturing.

This material is on the NRL list.

Exposure Hazards

Conversion Factor: 1 ppm = 6.08 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 2.1 ppm; Mar: 16 ppm; Crit: 81 ppm; Cat: —
PAC-1: 2.5 ppm; *PAC-2:* 26 ppm; *PAC-3:* 160 ppm

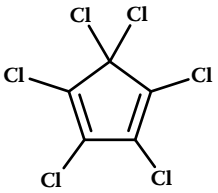
Properties:

MW: 148.6	*VP:* 3,800 mmHg (50°F)	*FlP:* NA
D: 2.5 g/mL (–35°F)	*VD:* 5.1	*LEL:* NA
MP: –35°F	*Vlt:* NA	*UEL*: NA
BP: Sublimes	*ER:* 330	*RP:* NA
Vsc: 0.1 cS (liq. gas, 77°F)	*H_2O:* Reacts	*IP:* 15.6 eV
	Sol: —	

C11-A085

Hexachlorocyclopentadiene

CAS: 77-47-4
RTECS: GY1225000
UN: 2646; 151
EC: 201-029-3
UNII: IP6ATU242I
ICD-11: —



$C_5\ Cl_6$

Dense, pale-yellow to amber-colored oily liquid with an unpleasant, musty odor detectable at ≥0.3 ppm. Vapors look like a blue haze. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Contact produces first- and second-degree burns, severe eye irritation with tearing (lacrimation). Severe respiratory irritant with difficulty breathing (dyspnea) and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed. Produces central nervous system depression.

Used to manufacture pesticides, shock proof plastics, acids, esters, ketones, flame retardants, fluorocarbons; used as biocide.

This material is on the ITF-25 Low Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 11.16 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: —; Mar: —; Crit: 0.018 ppm; Cat: —
PAC-1: 0.030 ppm; *PAC-2:* 0.55 ppm; *PAC-3:* 1.0 ppm
REL: 0.01 ppm
TLV: 0.01 ppm

Properties:

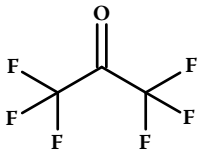
MW: 272.8	*VP:* 0.08 mmHg (77°F)	*FlP:* NA
D: 1.7 g/mL (77°F)	*VD:* 9.4	*LEL:* NA
MP: 16°F	*Vlt:* 110 ppm (77°F)	*UEL*: NA
BP: 462°F	*ER:* —	*RP:* 76
Vsc: 4.6 cS (77°F)	*H_2O:* 1.8 × 10^{-4}% (slowly decomposes)	*IP:* —
	Sol: Acetone, methanol, hexane	

C11-A086

Hexafluoroacetone

CAS: 684-16-2
RTECS: UC2450000
UN: 2420; 125
EC: 211-676-3

UNII: AKU9463N1Y
ICD-11: —



$C_3 F_6 O$

Colorless, hygroscopic gas with musty odor that becomes acrid in presence of acidic impurities. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Causes severe skin, eye, and respiratory irritation with difficulty breathing (dyspnea) and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed.

Used industrially for the synthesis of polymers, medicinals, agriculture chemicals, and as a component of high-performance fluoropolymers and in the manufacture of the solvent 1,1,1,3,3,3-hexafluoro-2-propanol.

This material is on the DHS Chemicals of Interest list and NRL list.

Exposure Hazards

Conversion Factor: 1 ppm = 6.79 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.10 ppm; Mar: 0.21 ppm; Crit: 80 ppm; Cat: —
PAC-1: 0.019 ppm; *PAC-2:* 0.21 ppm; *PAC-3:* 80 ppm
REL: 0.1 ppm [Skin]
TLV: 0.1 ppm [Skin]
IDLH: 9 ppm [Skin]

Final AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 0.20 ppm; 4 hr – 0.050 ppm; 8 hr – 0.025 ppm
AEGL-3: 1 hr – 80 ppm; 4 hr – 20 ppm; 8 hr – 10 ppm

Properties:

MW: 166.0	*VP:* 4,525 mmHg (70°F)	*FlP:* NA
D: 1.3 g/mL (liq. gas, 77°F)	*VD:* 5.7	*LEL:* NA
MP: –194°F	*Vlt:* NA	*UEL*: NA
BP: –18°F	*ER:* 190	*RP:* NA
Vsc: —	*H_2O:* Reacts	*IP:* 11.81 eV
	Sol: —	

C11-A087

Hydrogen Bromide, Anhydrous

CAS: 10035-10-6
RTECS: MW3850000
UN: 1048; 125
EC: 233-113-0
UNII: 3IY7CNP8XJ
ICD-11: —

HBr

Colorless to faintly yellow gas with a sharp, irritating acrid odor. Shipped as a liquefied compressed gas. This material is hazardous through inhalation and produces local skin/eye impacts. Causes severe skin, eye, and respiratory irritation with difficulty breathing (dyspnea) and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed.

Used industrially as a brominating agent, reducing agent and catalyst.

This material is on the DHS Chemicals of Interest list, ITF-25 High Threat list and NRL Critical Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 3.31 mg/m^3 at 77°F

$MEG_{(1hr)}$: Neg: 1.0 ppm; Mar: 22 ppm; Crit: 120 ppm; Cat: —

PAC-1: 1.0 ppm; *PAC-2:* 39 ppm; *PAC-3:* 120 ppm

PEL: 3 ppm

$Ceiling_{(ACGIH)}$: 2 ppm

$Ceiling_{(NIOSH)}$: 3 ppm

IDLH: 30 ppm

Final AEGLs

AEGL-1: 1 hr – 1.0 ppm; 4 hr – 1.0 ppm; 8 hr – 1.0 ppm

AEGL-2: 1 hr – 40 ppm; 4 hr – 10 ppm; 8 hr – 5.0 ppm

AEGL-3: 1 hr – 120 ppm; 4 hr – 31 ppm; 8 hr – 15 ppm

Properties:

MW: 80.9	*VP:* 15,000 mmHg	*FlP:* NA
D: 1.7 g/mL (liq. gas, 77°F)	*VD:* 2.8	*LEL:* NA
MP: –124°F	*Vlt:* NA	*UEL*: NA
BP: –88°F	*ER:* 510	*RP:* NA
Vsc: 0.12 cS (liq. gas, 77°F)	*H_2O:* 49%	*IP:* 11.62 eV
	Sol: Most organic solvents	

C11-A088

Hydrogen Chloride, Anhydrous

CAS: 7647-01-0

RTECS: MW4025000

UN: 1050; 125 / 2186; 125 (Refrigerated liquid)

EC: 231-595-7

UNII: QTT17582CB

ICD-11: XM97M0

HCl

Colorless to faintly yellow gas with a sharp, irritating acrid odor. Shipped as a liquefied compressed gas. This material is hazardous through inhalation, and ingestion, and produces local skin/eye impacts. Causes severe skin, eye, and respiratory irritation with difficulty breathing (dyspnea), asphyxiation due to swelling in the throat, possible inflammation of lung tissue (pneumonitis) and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed.

Used in metal treating/cleaning operations, petroleum well activation, refining ore in the production of tin and tantalum, hydrolyzing of starch and proteins in production of various foods, in the production synthetic rubber, vinyl chloride and alkyl chlorides; and in the manufacture of fertilizers, dyes and dyestuffs, artificial silk and pigments for paints.

This material is on the DHS Chemicals of Interest list, Australia Chemicals of Security Concern list, ITF-25 High Threat list, and NRL Critical Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 1.49 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 1.8 ppm; Mar: 22 ppm; Crit: 100 ppm; Cat: —
PAC-1: 1.8 ppm; *PAC-2:* 22 ppm; *PAC-3:* 100 ppm
$Ceiling_{(OSHA)}$: 5 ppm
$Ceiling_{(NIOSH)}$: 5 ppm
$Ceiling_{(ACGIH)}$: 2 ppm
IDLH: 50 ppm

Final AEGLs
AEGL-1: 1 hr – 1.8 ppm; 4 hr – 1.8 ppm; 8 hr – 1.8 ppm
AEGL-2: 1 hr – 22 ppm; 4 hr – 11 ppm; 8 hr – 11 ppm
AEGL-3: 1 hr – 100 ppm; 4 hr – 26 ppm; 8 hr – 26 ppm

Properties:

MW: 36.5	*VP:* 30,800 mmHg	*FlP:* NA
D: 0.80 g/mL (liq. gas, 77°F)	*VD:* 1.3	*LEL:* NA
MP: –174°F	*Vlt:* NA	*UEL*: NA
BP: –121°F	*ER:* 540	*RP:* NA
Vsc: 0.084 cS (liq. gas, 77°F)	*H_2O:* 67% (86°F)	*IP:* 12.74 eV
	Sol: Alcohol, benzene, ether	

C11-A089
Hydrogen Fluoride, Anhydrous
CAS: 7664-39-3
RTECS: MW7875000
UN: 1052; 125
EC: 231-634-8
UNII: RGL5YE86CZ
ICD-11: XM0E33; XM34T7 (Vapor)

HF

Colorless fuming liquid or gas with a strong; pungent, irritating odor. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Contact produces first- and second-degree burns, with possible severe, throbbing pain, rapid tissue destruction and possible bone erosion. Severe eye and respiratory irritation with difficulty breathing (dyspnea), asphyxiation due to swelling in the throat, possible inflammation of lung tissue (pneumonitis) and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed.

Used as an etchant in the manufacture of semiconductors, frosting/polishing agent (glass/enamel), aluminum brightening agent, metal cleaning, electropolishing bath ingredient, stainless steel pickling agent, to separate uranium isotopes; and as a chemical reagent in the dye chemistry.

This material is on the Australia Group Export Control list, DHS Chemicals of Interest list, ITF-25 High Threat list, and NRL Critical Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 0.82 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 1.0 ppm; Mar: 24 ppm; Crit: 44 ppm; Cat: —
PAC-1: 1.0 ppm; *PAC-2:* 24 ppm; *PAC-3:* 44 ppm
PEL: 3 ppm
REL: 3 ppm
TLV: 0.5 ppm [Skin] (as fluorine)
$Ceiling_{(ACGIH)}$: 2 ppm [Skin] (as fluorine)
$Ceiling_{(NIOSH)}$: 6 ppm
IDLH: 30 ppm

Final AEGLs
AEGL-1: 1 hr – 1.0 ppm; 4 hr – 1.0 ppm; 8 hr – 1.0 ppm
AEGL-2: 1 hr – 24 ppm; 4 hr – 12 ppm; 8 hr – 12 ppm
AEGL-3: 1 hr – 44 ppm; 4 hr – 22 ppm; 8 hr – 22 ppm

Properties:

MW: 20.0	*VP:* 783 mmHg	*FlP:* NA
D: 0.94 g/mL (liq. gas, 77°F)	*VD:* 0.69	*LEL:* NA
MP: –118°F	*Vlt:* NA	*UEL*: NA
BP: 67°F	*ER:* 1,100	*RP:* NA
Vsc: 0.22 cS (liq. gas, 77°F)	*H_2O:* Miscible	*IP:* 15.98 eV
	Sol: Alcohol	

C11-A090

Hydrogen Iodide, Anhydrous

CAS: 10034-85-2
RTECS: MW3760000
UN: 2197; 125
EC: 233-109-9
UNII: 694C0EFT9Q
ICD-11: —

HI

Colorless gas with a pungent, suffocating odor. Rapidly turns yellowish or brown on exposure to light and air. This material is hazardous through inhalation and produces local skin/eye impacts. Contact produces first- and second-degree burns; severe skin, eye, and respiratory irritation difficulty breathing (dyspnea), asphyxiation due to swelling in the throat, and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed.

Used industrially in the preparation of iodine salts, as a reducing agent, chemical analytical reagent, disinfectant, and in expectorant formulation; used in the manufacture of pharmaceuticals and other organic materials

This material is on the DHS Chemicals of Interest list, ITF-25 Low Threat list and NRL Critical Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 5.23 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 1.0 ppm; Mar: 23 ppm; Crit: 120 ppm; Cat: —
PAC-1: 0.99 ppm; *PAC-2:* 25 ppm; *PAC-3:* 120 ppm

Interim AEGLs
AEGL-1: 1 hr – 1.0 ppm; 4 hr – 1.0 ppm; 8 hr – 1.0 ppm
AEGL-2: 1 hr – 25 ppm; 4 hr – 13 ppm; 8 hr – 13 ppm
AEGL-3: 1 hr – 120 ppm; 4 hr – 31 ppm; 8 hr – 31 ppm

Properties:

MW: 127.9	*VP:* 5,637 mmHg	*FlP:* NA
D: 2.5 g/mL (liq. gas, 77°F)	*VD:* 4.4	*LEL:* NA
MP: –59°F	*Vlt:* NA	*UEL*: NA
BP: –32°F	*ER:* 480	*RP:* NA
Vsc: 0.24 cS (liq. gas, 77°F)	*H_2O:* Miscible	*IP:* 10.38 eV
	Sol: Alcohols	

C11-A091
Hydrogen Selenide
CAS: 7783-07-5
RTECS: MX1050000
UN: 2202; 117 / 3526; 176 (Absorbed)
EC: 231-978-9
UNII: V91P54KPAM
ICD-11: —

H_2Se

Colorless gas with a very offensive odor that resembles decayed horse radish detectable at ≥0.3 ppm. However, can cause olfactory fatigue and sense of smell is not reliable. Exposed personnel may experience garlic breath and a metallic taste after exposure. This material is hazardous through inhalation and produces local skin/eye impacts. Contact produces severe eye and respiratory irritation with difficulty breathing (dyspnea), dizziness, and weakness (lassitude), and possible inflammation of lung tissue (pneumonitis).

Used industrially for preparation of metallic selenides, organoselenium compounds, and preparation of semiconductor materials.

This material is on the DHS Chemicals of Interest list and ITF-25 Medium Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 3.31 mg/m^3 at 77°F
Intolerable Eye & Respiratory Irritation: 1.5 ppm; exposure duration unspecified
$MEG_{(1hr)}$: Neg: 0.11 ppm; Mar: 0.73 ppm; Crit: 2.2 ppm; Cat: —
PAC-1: 0.045 ppm; *PAC-2:* 0.11 ppm; *PAC-3:* 0.33 ppm
PEL: 0.05 ppm
REL: 0.05 ppm
TLV: 0.05 ppm (as selenium)
IDLH: 1 ppm

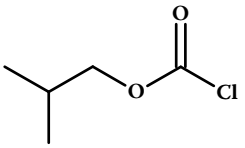
Final AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 0.11 ppm; 4 hr – 0.064 ppm; 8 hr – 0.048 ppm
AEGL-3: 1 hr – 0.33 ppm; 4 hr – 0.19 ppm; 8 hr – 0.14 ppm

Properties:

MW: 81.0	*VP:* 7,220 mmHg (70°F)	*FlP:* —
D: 1.8 g/mL (liq. gas, 77°F)	*VD:* 2.8	*LEL:* —
MP: –83.2°F	*Vlt:* NA	*UEL:* —
BP: –42°F	*ER:* 540	*RP:* NA
Vsc: 0.074 cS (liq. gas, 77°F)	*H_2O:* 0.64% (77°F)	*IP:* 9.88 eV
	Sol: Phosgene, carbon disulfide	

C11-A092

Isobutyl Chloroformate
CAS: 543-27-1
RTECS: —
UN: 2742; 155
EC: 208-840-1
UNII: 6S785TC0OB
ICD-11: —



C_5 H_9 Cl O_2

Clear, colorless liquid with a pungent, unpleasant odor. Commercial material may have a very faintly brown color. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts. Contact produces irritation with first- and second-degree skin and eye burns. Respiratory irritation with difficulty breathing (dyspnea) and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed.

Used for chemical synthesis.

This material is on the ITF-25 Low Threat list.

Exposure Hazards
Conversion Factor: 1 ppm = 5.59 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.63 ppm; Mar: 2.1 ppm; Crit: 6.6 ppm; Cat: —
PAC-1: 0.59 ppm; *PAC-2:* 2.1 ppm; *PAC-3:* 6.6 ppm

Final AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 2.2 ppm; 4 hr – 0.57 ppm; 8 hr – 0.28 ppm
AEGL-3: 1 hr – 6.7 ppm; 4 hr – 1.7 ppm; 8 hr – 0.83 ppm

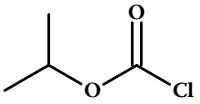
Properties:

MW: 136.6	*VP:* 6.5 mmHg	*FlP:* 87°F
D: 1.0 g/mL	*VD:* 4.7	*LEL:* —
MP: –112°F	*Vlt:* 8,700 ppm	*UEL*: —
BP: 264°F	*ER:* —	*RP:* 1.3
Vsc: —	*H_2O:* Reacts slowly	*IP:* —
	Sol: Benzene, chloroform, ether	

C11-A093

Isopropyl Chloroformate

CAS: 108-23-6
RTECS: LQ6475000
UN: 2407; 155
EC: 203-563-2
UNII: 8LG1G18VXR
ICD-11: —



C_4 H_7 Cl O_2

Colorless liquid with a strong odor. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts. Contact produces irritation with tearing (lacrimation) and first- and second-degree skin and eye burns. Respiratory irritation with difficulty breathing (dyspnea) and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed.

Used in the manufacture of pesticides, herbicides, veterinary medicines, polymerization initiators, blowing agents and other chemicals

This material is on the DHS Chemicals of Interest list and ITF-25 Low Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 5.01 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.40 ppm; Mar: 3.4 ppm; Crit: 10 ppm; Cat: —
PAC-1: 0.30 ppm; *PAC-2:* 3.4 ppm; *PAC-3:* 10 ppm

Final AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 3.3 ppm; 4 hr – 0.83 ppm; 8 hr – 0.43 ppm
AEGL-3: 1 hr – 10 ppm; 4 hr – 2.5 ppm; 8 hr – 1.3 ppm

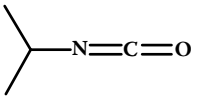
Properties:

MW: 122.6	*VP:* 22.5 mmHg	*FlP:* 68°F
D: 1.1 g/mL	*VD:* 4.2	*LEL:* 4%
MP: —	*Vlt:* 28,000 ppm	*UEL*: 15%
BP: 217°F	*ER:* —	*RP:* 0.43
Vsc: 0.60 cS	*H_2O:* Reacts slowly	*IP:* —
	Sol: Ether, benzene, acetone	

C11-A094

Isopropyl Isocyanate

CAS: 1795-48-8
RTECS: NQ9230000
UN: 2483; 155
EC: 217-276-5
UNII: —
ICD-11: —



$C_4\ H_7\ N\ O$

Clear, colorless to faint yellow liquid with a strong penetrating odor. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Causes severe skin, eye, and respiratory irritation with tearing (lacrimation) and difficulty breathing (dyspnea). It is a sensitizer and may cause allergic or asthmatic symptoms. Used industrially as an intermediate to manufacture pesticides and other chemicals.

This material is on the ITF-25 Low Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 3.48 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

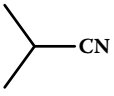
Properties:

MW: 85.1	*VP:* 82.5 mmHg	*FlP:* 27°F
D: 0.87 g/mL	*VD:* 2.9	*LEL:* —
MP: —	*Vlt:* 110,000 ppm	*UEL*: —
BP: 166°F	*ER:* 240	*RP:* 0.13
Vsc: —	*H_2O:* Reacts	*IP:* —
	Sol: —	

C11-A095

Isobutyronitrile

CAS: 78-82-0
RTECS: TZ4900000
UN: 2284; 131
EC: 201-147-5
UNII: 699AWF2WV2
ICD-11: —



$C_4\ H_7\ N$

Colorless liquid with an almond-like odor. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Causes severe skin, eye, and respiratory irritation with difficulty breathing (dyspnea), blue skin and lips (cyanosis), central nervous system depression, and convulsions.

Used industrially as a solvent, a catalyst in the polymerization of ethylene, and as an intermediate for insecticides.

This material is on the DHS Chemicals of Interest list.

Exposure Hazards

Conversion Factor: 1 ppm = 2.83 mg/m^3 at 77°F
MEG$_{(1hr)}$: Neg: 10 ppm; Mar: 18 ppm; Crit: 67 ppm; Cat: —
PAC-1: 0.18 ppm; *PAC-2:* 2.0 ppm; *PAC-3:* 6.0 ppm
REL: 8 ppm

Final AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 2.0 ppm; 4 hr – 1.3 ppm; 8 hr – 0.83 ppm
AEGL-3: 1 hr – 6.1 ppm; 4 hr – 3.8 ppm; 8 hr – 2.5 ppm

Properties:

MW: 69.1	*VP:* 32.7 mmHg (77°F)	*FlP:* 47°F
D: 0.77 g/mL	*VD:* 2.4	*LEL:* 1.6%
MP: –97°F	*Vlt:* 43,000 ppm	*UEL*: 12.7%
BP: 219°F	*ER:* 270	*RP:* 0.37
Vsc: 0.72 cS (60°F)	*H_2O:* Slight	*IP:* 11.7 eV
	Sol: Alcohol, ether, acetone	

C11-A096

Mercuric Chloride

CAS: 7487-94-7
RTECS: OV9100000
UN: 1624; 154
EC: 231-299-8
UNII: 53GH7MZT1R
ICD-11: XM9524

$HgCl_2$

White powder or crystalline material that is odorless. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Contact produces first- and second-degree burns, severe eye and respiratory irritation.

Used industrially as an insecticide and fungicide, for leather and fur production, and as a topical antiseptic and disinfectant.

This material is on the FBI list, Australia Chemicals of Security Concern list, and NRL High Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 11.10 mg/m^3 at 77°F
MEG$_{(1hr)}$: Neg: 0.18 ppm; Mar: —; Crit: 1.3 ppm; Cat: —
PAC-1: 0.0090 ppm; *PAC-2:* 0.013 ppm; *PAC-3:* 3.4 ppm

Properties:

MW: 271.5	*VP:* 1 mmHg (277°F)	*FlP:* NA
D: 5.6 g/cm^3	*VD:* 9.4	*LEL:* NA
MP: 531°F	*Vlt:* —	*UEL*: NA
BP: 576°F	*ER:* —	*RP:* 8.4
Vsc: —	*H_2O:* 33% (77°F)	*IP:* 11.38 eV
	Sol: Polar organic solvents	

C11-A097

Mercuric Nitrate

CAS: 10045-94-0
RTECS: OW8225000
UN: 1625; 141
EC: 233-152-3
UNII: 2FMV9338BW
ICD-11: —

$Hg(NO_3)_2$

White or slightly yellow, hygroscopic, crystalline powder with a sharp odor. Strong oxidizer, may spontaneously ignite combustibles. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Contact produces first- and second-degree burns, severe eye and respiratory irritation with difficulty breathing (dyspnea).

Used industrially to make felt; synthesize mercury fulminate and as an analytical reagent. This material is the Australia Chemicals of Security Concern list.

Exposure Hazards

Conversion Factor: NA
$MEG_{(1hr)}$: Neg: 0.041 mg/m^3; Mar: 0.16 mg/m^3; Crit: 16 mg/m^3; Cat: —
PAC-1: 0.12 mg/m^3; *PAC-2:* 0.16 mg/m^3; *PAC-3:* 45 mg/m^3

Properties:

MW: 324.6	*VP:* —	*FlP:* NA
D: 4.3 g/cm^3	*VD:* —	*LEL:* NA
MP: 174°F	*Vlt:* —	*UEL*: NA
BP: Decomposes	*ER:* —	*RP:* —
Vsc: —	*H_2O:* Soluble	*IP:* —
	Sol: Acetone	

C11-A098

Mercuric Oxide

CAS: 21908-53-2
RTECS: OW8750000
UN: 1641; 151
EC: 244-654-7
UNII: IY191986AO
ICD-11: XM5X38

HgO

Red to yellow heavy, crystalline powder or scales that is odorless. Strong oxidizer, may spontaneously ignite combustibles. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Causes skin, eye, and respiratory irritation with difficulty breathing (dyspnea).

Used industrially in paints, glass manufacturing as a fungicide, preservative in cosmetics and in some veterinarian medications.

This material is on the Australia Chemicals of Security Concern list.

Exposure Hazards

Conversion Factor: NA
$MEG_{(1hr)}$: Neg: 0.15 mg/m^3; Mar: 1.1 mg/m^3; Crit: 11 mg/m^3; Cat: —
PAC-1: 1.5 mg/m^3; *PAC-2:* 16 mg/m^3; *PAC-3:* 30 mg/m^3

Properties:

MW: 216.6	*VP:* —	*FlP:* NA
D: 11 mg/cm^3	*VD:* —	*LEL:* NA
MP: 932°F (decomposes)	*Vlt:* —	*UEL*: NA
BP: —	*ER:* —	*RP:* —
Vsc: —	*H_2O:* 0.053% (77°F)	*IP:* —
	Sol: Insoluble in organic solvents	

C11-A099

Mercurous Nitrate

CAS: 10415-75-5
RTECS: OW8000000
UN: 1627; 141
EC: 233-886-4
UNII: J78005WL7R
ICD-11: —

$HgNO_3$

Colorless to white crystalline material with a slight odor similar to nitric acid. Strong oxidizer, may spontaneously ignite combustibles. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Causes skin, eye, and respiratory irritation with difficulty breathing (dyspnea).

Used industrially to blacken brass; as an intermediate for the other mercury compounds, and an analytical reagent in chemistry.

This material is the Australia Chemicals of Security Concern list.

Exposure Hazards

Conversion Factor: NA
$MEG_{(1hr)}$: Neg: 0.033 mg/m^3; Mar: 0.13 mg/m^3; Crit: 13 mg/m^3; Cat: —
PAC-1: 0.098 mg/m^3; *PAC-2:* 0.13 mg/m^3; *PAC-3:* 37 mg/m^3

Properties:

MW: 262.6	*VP:* —	*FlP:* —
D: 4.8 g/cm^3	*VD:* —	*LEL:* —
MP: 158°F (decomposes)	*Vlt:* —	*UEL*: —
BP: —	*ER:* —	*RP:* —
Vsc: —	*H_2O:* 20%	*IP:* —
	Sol: —	

C11-A100

Mercury Cyanide

CAS: 592-04-1
RTECS: OW1515000
UN: 1636; 154
EC: 209-741-6
UNII: RWG7BD1032
ICD-11: XM39J4

$Hg(CN)_2$

Colorless or white, hygroscopic, crystalline powder that is odorless. Turns gray to dark brown on exposure to light. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Causes skin, eye, and respiratory irritation with difficulty breathing (dyspnea). May produce central nervous system depression with seizures and paralysis.

Used industrially for veterinarian medications, to make germicidal soaps, as a biocide, manufacturing cyanogen gas, and in photography.

This material is the Australia Chemicals of Security Concern list.

Exposure Hazards

Conversion Factor: NA
$MEG_{(1hr)}$: Neg: 1.5 mg/m^3; Mar: —; Crit: 13 mg/m^3; Cat: —
PAC-1: 0.094 mg/m^3; *PAC-2:* 0.13 mg/m^3; *PAC-3:* 35 mg/m^3

Properties:

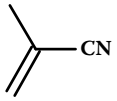
MW: 252.6	*VP:* —	*FlP:* NA
D: 4.0 g/cm^3 (77°F)	*VD:* —	*LEL:* NA
MP: 608°F (decomposes)	*Vlt:* —	*UEL*: NA
BP: —	*ER:* —	*RP:* —
Vsc: —	*H_2O:* 8%	*IP:* —
	Sol: Alcohols; slightly soluble in ether	

C11-A101

Methacrylonitrile

CAS: 126-98-7
RTECS: UD1400000
UN: 3079; 131P

EC: 204-817-5
UNII: 04S4K38612
ICD-11: —



$C_4\ H_5\ N$

Colorless to slight yellow liquid with a bitter almond odor. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Causes skin, eye, and respiratory irritation with tearing (lacrimation), difficulty breathing (dyspnea), central nervous system depression, and convulsions.

Used industrially to make plastics and coatings.

This material is on the DHS Chemicals of Interest list.

Exposure Hazards

Conversion Factor: 1 ppm = 2.74 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.99 ppm; Mar: 13 ppm; Crit: 25 ppm; Cat: —
PAC-1: 0.091 ppm; *PAC-2:* 0.99 ppm; *PAC-3:* 3.1 ppm
REL: 1 ppm [Skin]
TLV: 1 ppm [Skin]
IDLH: 4 ppm [Skin]

Final AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 1.0 ppm; 4 hr – 0.67 ppm; 8 hr – 0.33 ppm
AEGL-3: 1 hr – 3.1 ppm; 4 hr – 2.0 ppm; 8 hr – 0.99 ppm

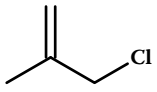
Properties:

MW: 67.1	*VP:* 71.2 mmHg (77°F)	*FlP:* 55°F
D: 0.80 g/mL	*VD:* 2.3	*LEL:* 2%
MP: –32°F	*Vlt:* 94,000 ppm	*UEL*: 6.8%
BP: 194°F	*ER:* 290	*RP:* 0.17
Vsc: 0.49 cS	*H_2O:* 2.5%	*IP:* 10.37
	Sol: Miscible in acetone, octane, toluene	

C11-A102

β-Methylallyl Chloride

CAS: 563-47-3
RTECS: UC8050000
UN: 2554; 130P
EC: 209-251-2
UNII: 7A9X1C3I3O
ICD-11: —



$C_4\ H_7\ Cl$

Colorless to pale yellow liquid with a sharp, penetrating, disagreeable odor. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts. Causes severe skin, eye, and respiratory irritation with tearing (lacrimation), difficulty breathing (dyspnea) and central nervous system depression.

Used industrially as a chemical intermediate for insecticides, plastics, and pharmaceuticals; and as a fumigant.

Exposure Hazards

Conversion Factor: 1 ppm = 3.70 mg/m^3 at 77°F
Concentrations above 1,500 ppm causes respiratory arrest (apnea).
MEG$_{(1hr)}$: Neg: 2.0 ppm; Mar: 16 ppm; Crit: 81 ppm; Cat: —
PAC-1: 1.2 ppm; *PAC-2:* 13 ppm; *PAC-3:* 46 ppm

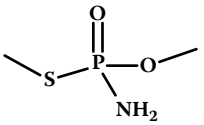
Properties:

MW: 90.6	*VP:* 101.7 mmHg	*FlP:* 10°F
D: 0.92 g/mL	*VD:* 3.1	*LEL:* 2.2%
MP: –112°F	*Vlt:* 140,000 ppm	*UEL*: 10.4%
BP: 160°F	*ER:* 240	*RP:* 0.10
Vsc: 4.6 cS	*H_2O:* 0.14% (decomposes slowly)	*IP:* —
	Sol: Alcohol, ether, chloroform	

C11-A103

Methamidophos

CAS: 10265-92-6
RTECS: TB4970000
UN: —
EC: 233-606-0
UNII: 8Z083FM94W
ICD-11: XM56W1



C_2 H_8 N O_2 P S

Colorless crystalline solid with a mercaptan odor. This material is hazardous through inhalation, skin absorption, and ingestion, and produces local skin/eye impacts. It is a cholinesterase inhibitor. Used industrially as an insecticide and acaricide.

This material is on the DHS Chemicals of Interest list, FBI list and NRL Critical Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 5.77 mg/m^3 at 77°F
MEG$_{(1hr)}$: Neg: 1.9 mg/m^3; Mar: 3.6 mg/m^3; Crit: 8.1 mg/m^3; Cat: —
PAC-1: 0.11 mg/m^3; *PAC-2:* 1.2 mg/m^3; *PAC-3:* 7.1 mg/m^3

Proposed AEGLs
AEGL-1: 1 hr – 1.9 mg/m^3; 4 hr – 1.2 mg/m^3; 8 hr – 0.61 mg/m^3
AEGL-2: 1 hr – 3.6 mg/m^3; 4 hr – 2.3 mg/m^3; 8 hr – 1.1 mg/m^3
AEGL-3: 1 hr – 8.1 mg/m^3; 4 hr – 5.1 mg/m^3; 8 hr – 2.5 mg/m^3

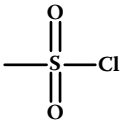
Properties:

MW: 141.1	*VP:* 3.5×10^{-5} mmHg (77°F)	*FlP:* —
D: 1.3 g/cm^3	*VD:* 4.9	*LEL:* —
MP: 113°F	*Vlt:* —	*UEL*: —
BP: Decomposes	*ER:* —	*RP:* —
Vsc: —	*H_2O:* Miscible	*IP:* —
	Sol: Alcohols, hexane, dichloromethane, toluene	

C11-A104

Methanesulfonyl Chloride

CAS: 124-63-0
RTECS: PB2790000
UN: 3246; 156
EC: 204-706-1
UNII: B17EWY1R7Q
ICD-11: —



C H_3 Cl O_2 S

Clear, colorless to slightly yellow oily liquid with a pungent odor. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Contact produces first- and second-degree burns, severe eye irritation. Severe respiratory irritant with difficulty breathing (dyspnea).

Used industrially as a chemical intermediate for pharmaceuticals and herbicides; used in the manufacture of flame-resistant products; used as a stabilizer for liquid sulfur trioxide.

This material is on the ITF-25 Medium Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 4.69 mg/m^3 at 77°F
Severe Eye Irritation: 1 ppm; exposure duration unspecified
Severe Respiratory Irritation: 10 ppm; exposure duration unspecified
$MEG_{(1hr)}$: Neg: 0.28 ppm; Mar: 2.1 ppm; Crit: 6.2 ppm; Cat: —
PAC-1: 0.019 ppm; *PAC-2:* 0.21 ppm; *PAC-3:* 0.62 ppm

Final AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 0.21ppm; 4 hr – 0.053 ppm; 8 hr – 0.026 ppm
AEGL-3: 1 hr – 0.62 ppm; 4 hr – 0.16 ppm; 8 hr – 0.078 ppm

Properties:

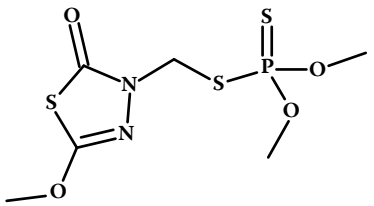
MW: 114.6	*VP:* 12 mmHg (127°F)	*FlP:* 230°F
D: 1.5 g/mL	*VD:* 4.0	*LEL:* —
MP: –27°F	*Vlt:* 14,000 ppm (127°F)	*UEL*: —

BP: 322°F	*ER:* —	*RP:* 0.86
Vsc: 1.3 cS (77° F)	*H_2O:* Insoluble (decomposes slowly)	*IP:* 11.6 eV
	Sol: Most organic solvents	

C11-A105

Methidathion

CAS: 950-37-8
RTECS: TE2100000
UN: —
EC: 213-449-4
UNII: Y2P145U7KK
ICD-11: XM83J2



$C_6\ H_{11}\ N_2\ O_4\ P\ S_3$

Colorless to white crystalline solid. This material is hazardous through inhalation, skin absorption, and ingestion, and produces local skin/eye impacts. It is a cholinesterase inhibitor.

Used industrially as an insecticide and acaricide.

This material is on the FBI lists, Australia Chemicals of Security Concern list and NRL Critical Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 12.37 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 3.0 mg/m^3; Mar: 20 mg/m^3; Crit: 400 mg/m^3; Cat: —
PAC-1: 1.8 mg/m^3; *PAC-2:* 20 mg/m^3; *PAC-3:* 160 mg/m^3

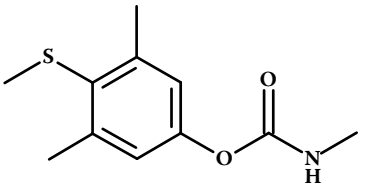
Properties:

MW: 302.3	*VP:* 3.4×10^{-6} mmHg (77°F)	*FlP:* 212°F
D: 1.5 g/cm^3	*VD:* 10	*LEL:* —
MP: 102°F	*Vlt:* —	*UEL*: —
BP: —	*ER:* —	*RP:* —
Vsc: —	*H_2O:* 0.019%	*IP:* —
	Sol: Most organic solvents	

C11-A106

Methiocarb

CAS: 2032-65-7
RTECS: FC5775000
UN: —
EC: 217-991-2
UNII: JI9431OS31
ICD-11: XM9Y05



C_{11} H_{15} N O_2 S

Colorless to white crystalline powder with a mild odor like phenol. This material is hazardous through inhalation, penetration through broken skin, and ingestion, and produces local skin/eye impacts. It is a cholinesterase inhibitor.

Dust may be explosive.

Used industrially as an insecticide, acaricide and molluscicide.

This material is on the Australia Chemicals of Security Concern list.

Exposure Hazards

$MEG_{(1hr)}$: Neg: 7.5 mg/m^3; Mar: —; Crit: 15 mg/m^3; Cat: —
PAC-1: 1.4 mg/m^3; *PAC-2:* 15 mg/m^3; *PAC-3:* 90 mg/m^3

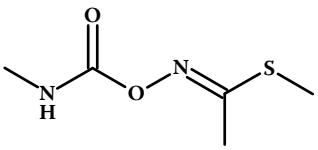
Properties:

MW: 225.3	*VP:* 2.7×10^{-7} mmHg (77°F)	*FlP:* —
D: 1.2 g/cm^3	*VD:* 7.8	*LEL:* —
MP: 246°F	*Vlt:* —	*UEL*: —
BP: —	*ER:* —	*RP:* —
Vsc: —	*H_2O:* 0.0027%	*IP:* —
	Sol: Most organic solvents	

C11-A107

Methomyl

CAS: 16752-77-5
RTECS: AK2975000
UN: —
EC: 240-815-0
UNII: 1NQ08HN02S
ICD-11: XM2CU6



C_5 H_{10} N_2 O_2 S

White, crystalline solid with a faint sulfur odor. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts. It is a cholinesterase inhibitor.

Used industrially as an insecticide, nematicide, and acaricide.

This material is on the FBI list, Australia Chemicals of Security Concern list and NRL High Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 6.63 mg/m^3 at 77°F
MEG$_{(1hr)}$: Neg: —; Mar: 5.7 mg/m^3; Crit: 17 mg/m^3; Cat: —
PAC-1: 0.91 mg/m^3; *PAC-2:* 10 mg/m^3; *PAC-3:* 23 mg/m^3
REL: 2.5 mg/m^3
TLV: 0.2 mg/m^3 [Skin]

Proposed AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 5.7 mg/m^3; 4 hr – 3.3 mg/m^3; 8 hr – 1.7 mg/m^3
AEGL-3: 1 hr – 17 mg/m^3; 4 hr – 10 mg/m^3; 8 hr – 5.2 mg/m^3

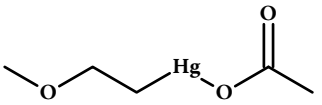
Properties:

MW: 162.2	*VP:* 5.4 × 10^{-6} mmHg (77°F)	*FlP:* NA
D: 1.3 g/cm^3 (75°F)	*VD:* 5.6	*LEL:* NA
MP: 172°F	*Vlt:* —	*UEL*: NA
BP: Decomposes	*ER:* —	*RP:* —
Vsc: —	*H_2O:* 5.8% (77°F)	*IP:* —
	Sol: Most organic solvents	

C11-A108

Methoxyethylmercury Acetate

CAS: 151-38-2
RTECS: —
UN: —
EC: 205-790-2
UNII: LS4R39JWSR
ICD-11: —



C_5 H_{10} Hg O_3

White crystalline material. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts. Causes skin, eye, and respiratory irritation with difficulty breathing (dyspnea), blue skin and lips (cyanosis), and convulsions. If ingested, can cause burning, prickling, itching, or tingling sensation (paresthesia) of the lips and mouth, excessive salivation, nausea, vomiting, and abdominal pain.

Used industrially as a fungicide and disinfectant.

This material is on the FBI list.

Exposure Hazards

Conversion Factor: 1 ppm = 13.03 mg/m^3 at 77°F
MEG$_{(1hr)}$: Neg: 0.048 mg/m^3; Mar: —; Crit: 3.2 mg/m^3; Cat: —
PAC-1: 0.048 mg/m^3; *PAC-2:* 0.064 mg/m^3; *PAC-3:* 3.2 mg/m^3

Properties:

MW: 318.7	*VP:* Negligible	*FlP:* —
D: 1.3 g/cm^3	*VD:* 11	*LEL:* —
MP: 108°F	*Vlt:* —	*UEL*: —
BP: 460°F (est.)	*ER:* —	*RP:* —
Vsc: —	*H_2O:* 3% (est.)	*IP:* —
	Sol: Polar organic solvents	

C11-A109

Methylamine

CAS: 74-89-5; 593-51-1 (Hydrochloride salt)
RTECS: PF6300000
UN: 1061; 118 / 1235 (Aqueous solution) 132
EC: 200-820-0
UNII: BSF23SJ79E; M439EX322K (Hydrochloride salt)
ICD-11: —

CH_3NH_2

Colorless gas or liquid with a fishy, ammonia-like odor. Various salts (solids) have been reported. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Contact produces first- and second-degree burns, severe eye irritation. Severe respiratory irritant with difficulty breathing (dyspnea) and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed.

Used industrially for making pharmaceuticals, insecticides, paint removers, surfactants, and rubber chemicals.

This material is on the NRL Critical Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 1.27 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 15 ppm; Mar: 63 ppm; Crit: 350 ppm; Cat: —
PAC-1: 15 ppm; *PAC-2:* 64 ppm; *PAC-3:* 350 ppm
PEL: 10 ppm
REL: 10 ppm
TLV: 5 ppm
$STEL_{(ACGIH)}$: 15 ppm
IDLH: 100 ppm

Interim AEGLs
AEGL-1: 1 hr – 15 ppm; 4 hr – 15 ppm; 8 hr – 15 ppm
AEGL-2: 1 hr – 64 ppm; 4 hr – 31 ppm; 8 hr – 21 ppm
AEGL-3: 1 hr – 350 ppm; 4 hr – 170 ppm; 8 hr – 110 ppm

Properties:

MW: 31.1	*VP:* 1,973 mmHg	*FlP:* –32°F
D: 0.69 g/mL	*VD:* 1.1	*FlP:* 14°F (40% aq. sol.)
MP: –136°F	*Vlt:* NA	*LEL:* 4.9%

BP: 21°F
Vsc: 0.29 cS (liq. gas)
ER: 530
H_2O: Miscible
Sol: Miscible in ethanol, benzene, acetone, and ether
UEL: 20.7%
RP: NA
IP: 8.9 eV

Hydrochloride Salt
MW: 67.5
D: 0.83 g/cm^3
MP: 449°F (Sublimes)
H_2O: Soluble

C11-A110

Methyl Bromide
CAS: 74-83-9
RTECS: PA4900000
UN: 1062; 123
EC: 200-813-2
UNII: 9V42E1Z7B6
ICD-11: XM0NK1

CH_3Br
Colorless gas that is odorless except at high concentrations; then it has a sweetish odor like chloroform. Some commercial mixtures also contain Chloropicrin (C10-A006). This material is hazardous through inhalation, skin absorption of the liquid, and ingestion, and the liquid produces local skin/eye impacts. Contact produces burning, prickling, itching, or tingling skin sensation (paresthesia), first- and second-degree burns, severe eye irritation. Severe respiratory irritant with difficulty breathing (dyspnea) and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed. Produces central nervous system depression.

Used industrially as a fumigant, herbicide and in organic synthesis.

This material is on the DHS Chemicals of Interest list, FBI list, ITF-25 Medium Threat list, and NRL Critical Threat list.

Exposure Hazards
Conversion Factor: 1 ppm = 3.88 mg/m^3 at 77°F
Lethal human toxicity values have not been fully established. However, deaths have been reported for exposures of 6% for one hour, and 1,600 ppm–8,200 ppm for 4–6 hours.
$MEG_{(1hr)}$: Neg: 21 ppm; Mar: 210 ppm; Crit: 750 ppm; Cat: —
PAC-1: 19 ppm; *PAC-2:* 210 ppm; *PAC-3:* 750 ppm
TLV: 1 ppm
$Ceiling_{(OSHA)}$: 20 ppm [Skin]
IDLH: 250 ppm [Skin]

Final AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 210 ppm; 4 hr – 67 ppm; 8 hr – 67 ppm
AEGL-3: 1 hr – 740 ppm; 4 hr – 230 ppm; 8 hr – 130 ppm

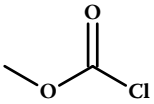
Properties:

MW: 94.9	*VP:* 1,420 mmHg	*FlP:* –29.2°F
D: 1.7 g/mL (32°F)	*VD:* 3.3	*LEL:* 10%
MP: –135°F	*Vlt:* —	*UEL*: 16%
BP: 38°F	*ER:* 400	*RP:* —
Vsc: 0.23 cS (32°F)	*H_2O:* 1.3% (77°F)	*IP:* 10.54 eV
	Sol: Ethanol, chloroform, ether	

C11-A111

Methyl Chloroformate

CAS: 79-22-1
RTECS: FG3675000
UN: 1238; 155
EC: 201-187-3
UNII: RC6VA8OB2N
ICD-11: XM6RK9



C_2 H_3 Cl O_2

Clear, colorless to light yellow liquid with a sharp, unpleasant, acrid odor. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Contact produces first- and second-degree burns, severe eye irritation with tearing (lacrimation). Severe respiratory irritant with difficulty breathing (dyspnea) and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed.

Used industrially in the manufacture of carbamates, pesticides, herbicides, insecticides, and pharmaceuticals; used as a solvent in the photographic industry.

This material is on the DHS Chemicals of Interest list and ITF-25 Medium Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 3.87 mg/m^3 at 77°F
$LC_{(1nh)}$: 190 ppm for a 10-minute exposure
Lacrimation: 10 ppm, exposure duration unspecified
$MEG_{(1hr)}$: Neg: 0.34 ppm; Mar: 2.2 ppm; Crit: 6.7 ppm; Cat: —
PAC-1: 0.59 ppm; *PAC-2:* 2.2 ppm; *PAC-3:* 6.7 ppm

Final AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 2.2 ppm; 4 hr – 1.4 ppm; 8 hr – 0.70 ppm
AEGL-3: 1 hr – 6.7 ppm; 4 hr – 4.2 ppm; 8 hr – 2.1 ppm

Properties:

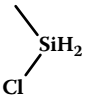
MW: 94.5	*VP:* 108.5 mmHg (77°F)	*FlP:* 76°F
D: 1.2 g/mL	*VD:* 3.3	*LEL:* 6.7%
MP: –78°F	*Vlt:* 140,000 ppm (77°F)	*UEL*: 23%

BP: 159°F	*ER:* 310	*RP:* 0.096
Vsc: 0.39 cS	*H_2O:* Slight (decomposes slowly)	*IP:* —
	Sol: Alcohol, ether, benzene	

C11-A112

Methyl Chlorosilane

CAS: 993-00-0
RTECS: —
UN: 2534; 119
EC: 213-600-4
UNII: —
ICD-11: —



C H_5 Cl Si

Colorless liquid or gas. This material is hazardous through inhalation and produces local skin/eye impacts. Contact produces first- and second-degree burns, severe eye irritation. Severe respiratory irritant with difficulty breathing (dyspnea) and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed.

Used industrially to make repellant materials.

This material is on the DHS Chemicals of Interest list and ITF-25 Medium Threat list

Exposure Hazards

Conversion Factor: 1 ppm = 3.30 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 1.9 ppm; Mar: 23 ppm; Crit: 110 ppm; Cat: —
PAC-1: 1.9 ppm; *PAC-2:* 23 ppm; *PAC-3:* 110 ppm

Final AEGLs
AEGL-1: 1 hr – 1.8 ppm; 4 hr – 1.8 ppm; 8 hr – 1.8 ppm
AEGL-2: 1 hr – 22 ppm; 4 hr – 11 ppm; 8 hr – 11 ppm
AEGL-3: 1 hr – 100 ppm; 4 hr – 26 ppm; 8 hr – 26 ppm

Properties:

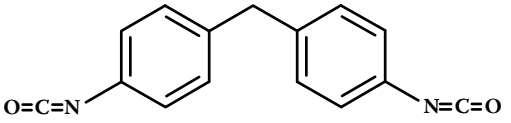
MW: 80.6	*VP:* 137 mmHg	*FlP:* 16°F
D: 0.88 g/mL	*VD:* 2.8	*LEL:* —
MP: –209°F	*Vlt:* 180,000 ppm	*UEL:* —
BP: —	*ER:* 260	*RP:* 0.08
Vsc: —	*H_2O:* Reacts	*IP:* —
	Sol: —	

C11-A113

Methylene Bisphenyl Diisocyanate

CAS: 101-68-8
RTECS: NQ9350000
UN: —

EC: 202-966-0
UNII: B0LO6BBS8C
ICD-11: —



C_{15} H_{10} N_2 O_2

White to light-yellow crystalline solid that is odorless. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts. Causes skin, eye, and respiratory irritation with tearing (lacrimation), difficulty breathing (dyspnea) and headache. It causes respiratory sensitization.

Used industrially to manufacture adhesives, coatings, elastomers, and polyurethane foams.

This material is on the ITF-25 Low Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 10.24 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.20 mg/m^3; Mar: 2.0 mg/m^3; Crit: 25 mg/m^3; Cat: —
PAC-1: 0.45 mg/m^3; *PAC-2:* 5.0 mg/m^3; *PAC-3:* 55 mg/m^3
REL: 0.05 mg/m^3
TLV: 0.005 ppm
$Ceiling_{(OSHA)}$: 0.2 mg/m^3
$Ceiling_{(NIOSH)}$: 0.2 mg/m^3
IDLH: 75 mg/m^3

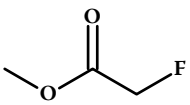
Properties:

MW: 250.3	*VP:* 5 × 10^{-6} mmHg (77°F)	*FlP:* 390°F
D: 1.2 g/cm^3 (77°F)	*VD:* 8.6	*LEL:* —
MP: 99°F	*Vlt:* —	*UEL*: —
BP: Polymerizes	*ER:* —	*RP:* —
Vsc: 4.2 cS (122°F)	*H_2O:* 0.2% (decomposes slowly)	*IP:* —
	Sol: Acetone, toluene, ether	

C11-A114

Methyl Fluoroacetate

CAS: 453-18-9
RTECS: AH8400000
UN: —
EC: 207-218-7
UNII: MO8U9H1FAS
ICD-11: —



C_3 H_5 F O_2

Mobile liquid that is practically odorless with a faint, fruit-like odor. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Effects include difficulty breathing (dyspnea), blue skin and lips (cyanosis), irregular heartbeat (cardiac arrhythmias), and convulsions. Symptoms may be delayed.
Used industrially as a rodenticide.

This material is the Australia Chemicals of Security Concern list.

Exposure Hazards

Conversion Factor: 1 ppm = 3.77 mg/m^3 at 77°F
MEG$_{(1hr)}$: Neg: 0.013 ppm; Mar: 0.093 ppm; Crit: 1.3 ppm; Cat: —
PAC-1: 0.0056 ppm; *PAC-2:* 0.061 ppm; *PAC-3:* 0.37 ppm

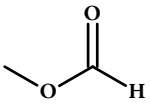
Properties:

MW: 92.1	*VP:* 30.9 (77°F) (est.)	*FlP:* —
D: 1.2 g/mL	*VD:* 3.2	*LEL:* —
MP: –31°F	*Vlt:* 40,000 ppm	*UEL*: —
BP: 219°F	*ER:* —	*RP:* 0.34
Vsc: —	*H_2O:* 15%	*IP:* 10.90 eV
	Sol: Petroleum ether	

C11-A115

Methyl Formate

CAS: 107-31-3
RTECS: LQ8925000
UN: 1243; 129
EC: 203-481-7
UNII: 1MPH591FTG
ICD-11: —



C_2 H_4 O_2

Colorless liquid with an agreeable odor. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Causes skin, eye, and respiratory irritation with difficulty breathing (dyspnea) and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed. Produces central nervous system depression.

Used industrially as a fumigant, insecticide, and refrigerant.

This material is on the DHS Chemicals of Interest list.

Exposure Hazards

Conversion Factor: 1 ppm = 2.46 mg/m^3 at 77°F
MEG$_{(1hr)}$: Neg: 140 ppm; Mar: 810 ppm; Crit: 4,100 ppm; Cat: —
PAC-1: 100 ppm; *PAC-2:* 810 ppm; *PAC-3:* 4,900 ppm
PEL: 100 ppm
REL: 100 ppm
TLV: 50 ppm

$STEL_{(ACGIH)}$: 100 ppm
$STEL_{(NIOSH)}$: 150 ppm
IDLH: 4,500 ppm

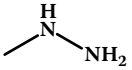
Properties:

MW: 60.1	*VP:* 476 mmHg	*FlP:* –2°F
D: 0.98 g/mL	*VD:* 2.1	*LEL:* 4.5%
MP: –148°F	*Vlt:* 640,000 ppm	*UEL*: 23%
BP: 89°F	*ER:* 390	*RP:* 0.027
Vsc: 0.33 cS	*H_2O:* 30%	*IP:* 10.82 eV
	Sol: Ethanol, ether, chloroform	

C11-A116

Methylhydrazine

CAS: 60-34-4; 7339-53-9 (Hydrochloride salt)
RTECS: MV5600000
UN: 1244; 131
EC: 200-471-4
UNII: UWA30B5Z1J
ICD-11: XM0WH6



C H_6 N_2

Hygroscopic, clear, colorless, fuming liquid with an odor like ammonia that is detectable ≥2.8 ppm. Various salts (solids) have been reported. May spontaneously ignite on contact with oxidizers or porous materials. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Contact produces first- and second-degree burns, severe eye irritation. Severe respiratory irritant with difficulty breathing (dyspnea), blue skin and lips (cyanosis), central nervous system depression, and convulsions. Symptoms may be delayed.

Used industrially to manufacture pesticides, pharmaceuticals; used as a solvent, and as a rocket fuel.

This material is on the DHS Chemicals of Interest list and ITF-25 Medium Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 1.89 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.19 ppm; Mar: 0.90 ppm; Crit: 2.7 ppm; Cat: —
PAC-1: 0.079 ppm; *PAC-2:* 0.90 ppm; *PAC-3:* 2.7 ppm
TLV: 0.01 ppm [Skin]
$Ceiling_{(OSHA)}$: 0.2 ppm [Skin]
$Ceiling_{(NIOSH)}$: 0.04 ppm [Skin]
IDLH: 20 ppm [Skin]

Final AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 0.90 ppm; 4 hr – 0.23 ppm; 8 hr – 0.11 ppm
AEGL-3: 1 hr – 2.7 ppm; 4 hr – 0.68 ppm; 8 hr – 0.34 ppm

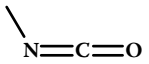
Properties:

MW: 46.1	*VP:* 38 mmHg	*FlP:* 17°F
D: 0.87 g/mL (77°F)	*VD:* 1.6	*LEL:* 2.5%
MP: –62°F	*Vlt:* 51,000 ppm	*UEL*: 92%
BP: 190°F	*ER:* 460	*RP:* 0.39
Vsc: 0.89 cS (77°F)	*H_2O:* Miscible	*IP:* 7.70 eV
	Sol: Ether, alcohols, hydrocarbons	

C11-A117

Methyl Isocyanate

CAS: 624-83-9
RTECS: NQ9450000
UN: 2480; 155
EC: 210-866-3
UNII: C588JJ4BV9
ICD-11: —



C_2 H_3 N O

Colorless liquid with a strong, sharp, pungent odor. However, less than 10% of attentive persons can detect this material at the industrial exposure limits. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Causes severe skin, eye, and respiratory irritation with difficulty breathing (dyspnea) and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed. It causes sensitization through both inhalation and skin contact.

Used industrially as an intermediate to manufacture pesticides, polyurethane foams, and plastics.

This material is on the DHS Chemicals of Interest list and ITF-25 Medium Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 2.34 mg/m^3 at 77°F
Eye Irritation: 2 ppm; exposure duration unspecified
Unbearable Irritation: 21 ppm; exposure duration unspecified
$MEG_{(1hr)}$: Neg: 0.025 ppm; Mar: 0.068 ppm; Crit: 0.20 ppm; Cat: —
PAC-1: 0.025 ppm; *PAC-2:* 0.068 ppm; *PAC-3:* 0.20 ppm
PEL: 0.02 ppm [Skin]
REL: 0.02 ppm [Skin]
TLV: 0.02 ppm [Skin]
$STEL_{(ACGIH)}$: 0.06 ppm [Skin]
IDLH: 0.12 ppm [Skin]

Final AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 0.067 ppm; 4 hr – 0.017 ppm; 8 hr – 0.0080 ppm
AEGL-3: 1 hr – 0.20 ppm; 4 hr – 0.05 ppm; 8 hr – 0.025 ppm

Properties:

MW: 57.1	*VP:* 348 mmHg	*FlP:* 19°F
D: 0.96 g/mL	*VD:* 1.4	*LEL:* 5.3%
MP: –49°F	*Vlt:* 470,000 ppm	*UEL*: 26%
BP: 103°F	*ER:* 400	*RP:* 0.38
Vsc: —	*H_2O:* 10% (59°F; decomposes slowly)	*IP:* 10.67 eV
	Sol: —	

C11-A118

Methyl Mercaptan

CAS: 74-93-1
RTECS: PB4375000
UN: 1064; 117
EC: 200-822-1
UNII: 2X8406WW9I
ICD-11: XM4FU5

CH_3SH

Colorless gas or water-white liquid with a disagreeable odor like garlic or rotten cabbage that is detectable at ≥0.0021 ppm. This material is hazardous through inhalation and produces local skin/eye impacts. Causes eye and respiratory irritation with difficulty breathing (dyspnea), blue skin and lips (cyanosis), central nervous system depression, and convulsions. Symptoms may be delayed.

Used as a gas odorant; used to manufacture methionine, plastics, jet fuel additives, pesticides, fungicides; used as a catalyst and as a synthetic flavoring

This material is on the DHS Chemicals of Interest list and ITF-25 Medium Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 1.97 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.0050 ppm; Mar: 47 ppm; Crit: 66 ppm; Cat: —
PAC-1: 0.0050 ppm; *PAC-2:* 23 ppm; *PAC-3:* 66 ppm
TLV: 0.5 ppm
$Ceiling_{(OSHA)}$: 10 ppm
$Ceiling_{(NIOSH)}$: 0.5 ppm
IDLH: 150 ppm

Final AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 23 ppm; 4 hr – 14 ppm; 8 hr – 7.3 ppm
AEGL-3: 1 hr – 68 ppm; 4 hr – 43 ppm; 8 hr – 22 ppm

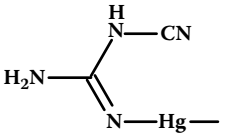
Properties:

MW: 48.1	*VP:* 1,300 mmHg	*FlP:* 64°F
D: 0.86 g/mL (77°F)	*VD:* 1.7	*LEL:* 3.9%
MP: –189°F	*Vlt:* NA	*UEL*: 21.8%
BP: 43°F	*ER:* 440	*RP:* NA
Vsc: 0.29 cS (liq. gas, 77°F)	*H_2O:* 1.54% (77°F)	*IP:* 9.44 eV
	Sol: Alcohol, ether, petroleum naphtha	

C11-A119

Methylmercury Dicyandiamide

CAS: 502-39-6
RTECS: —
UN: —
EC: 207-935-5
UNII: FO98N7765W
ICD-11: —



$C_3\ H_6\ Hg\ N_4$

Colorless crystalline solid. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts. Effects include severe skin irritant with blisters (vesiculation); respiratory irritant with difficulty breathing (dyspnea); and central nervous effects including confusion, hallucinations and seizures.

Used industrially as a seed fungicide and disinfectant, and a timber preservative.

This material is on the FBI list.

Exposure Hazards

Conversion Factor: 1 ppm = 12.22 mg/m^3 at 77°F
$LD_{50\ (Ing)}$: 0.35 – 3.5 g
$MEG_{(1hr)}$: Neg: 0.045 mg/m^3; Mar: —; Crit: 3.0 mg/m^3; Cat: —
PAC-1: 0.045 mg/m^3; *PAC-2:* 0.060 mg/m^3; *PAC-3:* 3.0 mg/m^3

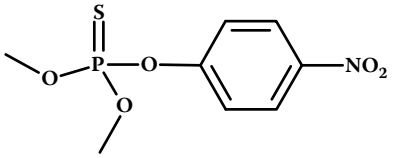
Properties:

MW: 298.7	*VP:* 6.5 × 10^{-5} mmHg (95°F)	*FlP:* —
D: —	*VD:* 10	*LEL:* —
MP: 313°F	*Vlt:* —	*UEL*: —
BP: —	*ER:* —	*RP:* —
Vsc: —	*H_2O:* 2.17%	*IP:* —
	Sol: Acetone, ethanol, ethylene glycol	

C11-A120

Methyl Parathion

CAS: 298-00-0
RTECS: TG0175000
UN: —
EC: 206-050-1
UNII: 41BCL2O91D
ICD-11: XM1YY0



$C_8\ H_{10}\ N\ O_5\ P\ S$

White to tan, crystalline solid or powder. Pure material is odorless; impurities can give it a pungent odor like garlic or rotten eggs. This material is hazardous through inhalation, skin absorption, and ingestion, and produces local skin/eye impacts. It is a cholinesterase inhibitor.

Used industrially as an insecticide and acaricide.

This material is on the FBI list, Australia Chemicals of Security Concern list, and NRL Critical Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 10.77 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.060 mg/m^3; Mar: 1.2 mg/m^3; Crit: 3.5 mg/m^3; Cat: —
PAC-1: 0.11 mg/m^3; *PAC-2:* 1.2 mg/m^3; *PAC-3:* 3.5 mg/m^3
REL: 0.2 mg/m^3 [Skin]
TLV: 0.02 mg/m^3 [Skin]

Interim AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 1.2 mg/m^3; 4 hr – 0.73 mg/m^3; 8 hr – 0.37 mg/m^3
AEGL-3: 1 hr – 3.5 mg/m^3; 4 hr – 2.2 mg/m^3; 8 hr – 1.1 mg/m^3

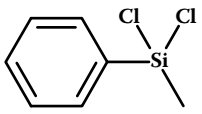
Properties:

MW: 263.2	*VP:* 3.5 × 10^{-6} mmHg (77°F)	*FlP:* —
D: 1.4 g/cm^3	*VD:* 9.1	*LEL:* —
MP: 96°F	*Vlt:* —	*UEL:* —
BP: 309°F (1 mmHg)	*ER:* —	*RP:* —
Vsc: —	*H_2O:* 0.0055%	*IP:* —
	Sol: Most organic solvents	

C11-A121

Methylphenyldichlorosilane

CAS: 149-74-6
RTECS: VV3530000
UN: 2437; 156
EC: 205-746-2
UNII: 9JR2A9V0JI
ICD-11: —



$C_7\ H_8\ Cl_2\ Si$

Colorless liquid with an acrid odor. This material is hazardous through inhalation, and ingestion, and produces local skin/eye impacts. Contact produces first- and second-degree burns, severe eye irritation. Severe respiratory irritant with difficulty breathing (dyspnea) and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed.

Used industrially as a chemical intermediate for silicon fluids, resins, and elastomers.

This material is on the NRL Critical Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 7.82 mg/m^3 at 77°F
MEG$_{(1hr)}$: Neg: 0.38 ppm; Mar: —; Crit: 2.6 ppm; Cat: —
PAC-1: 0.90 ppm; *PAC-2:* 11 ppm; *PAC-3:* 50 ppm

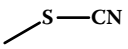
Properties:

MW: 191.1	*VP:* 0.49 mmHg (77°F)	*FlP:* 153°F
D: 1.2 g/mL	*VD:* 6.6	*LEL:* 3.4%
MP: −63°F	*Vlt:* 640 ppm	*UEL*: 9.5%
BP: 404°F	*ER:* —	*RP:* 14.9
Vsc: —	*H_2O:* Reacts	*IP:* 9.52 eV
	Sol: Benzene, ether	

C11-A122

Methyl Thiocyanate

CAS: 556-64-9
RTECS: XL1575000
UN: —
EC: 209-134-6
UNII: 55I23VY6IE
ICD-11: —



C_2 H_3 N S

Colorless to light-yellow liquid with a pungent onion-like odor. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Effects include central nervous system depression, hallucinations, weakness (asthenia), cessation of breathing (apnea), convulsions, and coma.

Used industrially as a fumigant, insecticide and pharmaceutical intermediate.

This material is on the DHS Chemicals of Interest list.

Exposure Hazards

Conversion Factor: 1 ppm = 2.99 mg/m^3 at 77°F
MEG$_{(1hr)}$: Neg: 13 ppm; Mar: —; Crit: 25 ppm; Cat: —
PAC-1: 17 ppm; *PAC-2:* 28 ppm; *PAC-3:* 140 ppm

Properties:

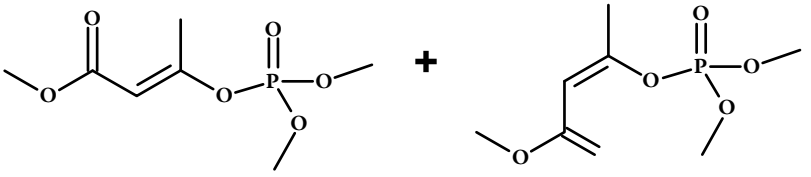
MW: 73.1	*VP:* 12.1 mmHg (77°F)	*FlP:* 100°F
D: 1.1 g/mL	*VD:* 2.5	*LEL:* —
MP: −60°F	*Vlt:* 16,000 ppm	*UEL*: —

BP: 266°F	*ER:* 360	*RP:* 0.98
Vsc: —	*H_2O:* Very slightly	*IP:* 9.96 eV
	Sol: Miscible in alcohol, ether	

C11-A123

Mevinphos

CAS: 7786-34-7
RTECS: GQ5250000
UN: —
EC: 232-095-1
UNII: 14ZYO4IKXT
ICD-11: XM8ZT2



Trans (E-) isomer Cis (Z-) isomer

$C_7\ H_{13}\ O_6\ P$

Pale-yellow to orange liquid with a mild or weak odor. Commercial material is a mixture of the two isomers. This material is hazardous through inhalation, skin absorption, and ingestion, and produces local skin/eye impacts. It is a cholinesterase inhibitor.

Used industrially as an insecticide, acaricide and avicide.

This material is on the FBI list and Australia Chemicals of Security Concern list.

Exposure Hazards

Conversion Factor: 1 ppm = 9.17 mg/m^3 at 77°F
The cis (or Z-) isomer is about one hundred times more toxic than the trans (or E-) isomer.
$MEG_{(1hr)}$: Neg: 0.30 mg/m^3; Mar: 4.0 mg/m^3; Crit: 37 mg/m^3; Cat: —
PAC-1: 0.30 mg/m^3; *PAC-2:* 4.0 mg/m^3; *PAC-3:* 40 mg/m^3
PEL: 0. 1 mg/m^3 [Skin]
REL: 0.1 mg/m^3 [Skin]
TLV: 0.01 mg/m^3 [Skin]
$STEL_{(NIOSH)}$: 0.3 mg/m^3 [Skin]
IDLH: 37 mg/m^3 [Skin]

Properties:

MW: 224.1	*VP:* 0.0029 mmHg	*FlP:* 347°F
D: 1.3 g/mL	*VD:* 7.7	*LEL:* —
MP: 70°F (Z isomer)	*Vlt:* 0.17 ppm	*UEL:* —
MP: 44°F (E isomer)	*ER:* —	*RP:* 52,000
BP: Decomposes	*H_2O:* Miscible (decomposes rapidly)	*IP:* —
Vsc: 6.6 cS (77°F)	*Sol:* Most organic solvents	

C11-A124

Molybdophosphoric Acid

CAS: 51429-74-4
RTECS: —
UN: —
EC: 234-713-5
UNII: RN225F04V1
ICD-11: —

H_3PO_4 • 12MoO_3 • H_2O

H_5 Mo_{12} O_{41} P

Crystalline yellow hygroscopic solid that is odorless. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts. Contact produces first- and second-degree burns, severe eye irritation. Inhalation causes respiratory irritation with difficulty breathing (dyspnea).

Used industrially in hybrid batteries and as an analytical reagent for staining.

This material is on the NRL Critical Threat list.

Exposure Hazards

Conversion Factor: NA
$MEG_{(1hr)}$: Neg: 2.4 mg/m^3; Mar: 4.0 mg/m^3; Crit: 500 mg/m^3; Cat: —
PAC-1: 2.4 mg/m^3; *PAC-2:* 27 mg/m^3; *PAC-3:* 160 mg/m^3

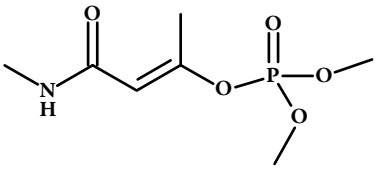
Properties:

MW: 1,825.3 + xH_2O	*VP:* —	*FlP:* NA
D: 1.6 g/cm^3 (77°F)	*VD:* —	*LEL:* NA
MP: 174°F	*Vlt:* —	*UEL*: NA
BP: —	*ER:* NA	*RP:* NA
Vsc: —	*H_2O:* Soluble	*IP:* —
	Sol: Ethanol, ether	

C11-A125

Monocrotophos

CAS: 6923-22-4
RTECS: TC4375000
UN: —
EC: 230-042-7
UNII: 5Q3PE07Z18
ICD-11: XM27J3



C_7 H_{14} N O_5 P

Colorless to reddish-brown hygroscopic crystalline solid with a mild odor. This material is hazardous through inhalation, skin absorption, and ingestion, and produces local skin/eye impacts. It is a cholinesterase inhibitor.

Used industrially as an insecticide and acaricide.

This material is on the FBI list.

Exposure Hazards

Conversion Factor: 1 ppm = 9.13 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.15 mg/m^3; Mar: 0.24 mg/m^3; Crit: 0.73 mg/m^3; Cat: —
PAC-1: 0.15 mg/m^3; *PAC-2:* 0.63 mg/m^3; *PAC-3:* 3.5 mg/m^3
REL: 0.25 mg/m^3
TLV: 0.05 mg/m^3 [Skin]

Proposed AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 0.24 mg/m^3; 4 hr – 0.21 mg/m^3; 8 hr – 0.10 mg/m^3
AEGL-3: 1 hr – 0.73 mg/m^3; 4 hr – 0.62 mg/m^3; 8 hr – 0.31 mg/m^3

Properties:

MW: 223.2	*VP:* 2.2 × 10^{-6} mmHg	*FlP:* —
D: 1.2 g/cm^3	*VD:* 7.7	*LEL:* —
MP: 129°F	*Vlt:* —	*UEL:* —
MP: 77°–86°F (commercial grade)	*ER:* —	*RP:* —
BP: 257°F (5 × 10^{-4} mmHg)	*H_2O:* Miscible	*IP:* —
Vsc: —	*Sol:* Acetone, alcohols	

C11-A126

Fuming Nitric Acid

CAS: 52583-42-3
RTECS: QU5775000
UN: 2032; 157
EC: 231-714-2
UNII: 411VRN1TV4
ICD-11: XM5NZ1; XM5CC8 (Nitric acid vapor)

HNO_3 + N_2O_4

Fuming nitric acid is concentrated acid that contains dissolved nitrogen dioxide (C11-A128). It is a colorless, yellow, or red, fuming liquid with an acrid, suffocating odor. Fumes are primarily nitrogen dioxide (C11-A128). This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts. Contact produces first- and second-degree burns, staining skin yellow. Severe eye irritation with tearing (lacrimation). Severe respiratory irritant with difficulty breathing (dyspnea); possible inflammation of lung tissue (pneumonitis) and accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed.

Used in the manufacture of pharmaceuticals, dye intermediates, explosives, various inorganic and organic nitrates, nitro compounds; and used industrially for ore flotation, metallurgy, photoengraving and reprocessing spent nuclear fuel.

This material is on the DHS Chemicals of Interest list, the ITF-25 High Threat list, and NRL High Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 2.58 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

The following exposure limits have been developed for *nitric acid*.

$MEG_{(1hr)}$: Neg: 0.54 ppm; Mar: 24 ppm; Crit: 93 ppm; Cat: —
PAC-1: 0.16 ppm; *PAC-2:* 24 ppm; *PAC-3:* 92 ppm
PEL: 2 ppm
REL: 2 ppm
$STEL_{(NIOSH)}$: 4 ppm
IDLH: 25 ppm

The following exposure limits have been developed for *nitrogen dioxide*.

$MEG_{(1hr)}$: Neg: 0.50 ppm; Mar: 12 ppm; Crit: 20 ppm; Cat: —
PAC-1: 0.50 ppm; *PAC-2:* 12 ppm; *PAC-3:* 20 ppm
$STEL_{(NIOSH)}$: 1 ppm
$Ceiling_{(OSHA)}$: 5 ppm
IDLH: 13 ppm

Interim AEGLs (for *nitric acid*)

AEGL-1: 1 hr – 0.53 ppm; 4 hr – 0.53 ppm; 8 hr – 0.53 ppm
AEGL-2: 1 hr – 24 ppm; 4 hr – 6.0 ppm; 8 hr – 3.0 ppm
AEGL-3: 1 hr – 92 ppm; 4 hr – 23 ppm; 8 hr – 11 ppm

Interim AEGLs (for *nitrogen dioxide*)

AEGL-1: 1 hr – 0.50 ppm; 4 hr – 0. 50 ppm; 8 hr – 0. 50 ppm
AEGL-2: 1 hr – 12 ppm; 4 hr – 8.2 ppm; 8 hr – 6.7 ppm
AEGL-3: 1 hr – 20 ppm; 4 hr – 14 ppm; 8 hr – 11 ppm

Properties: for a mixture of >90% nitric acid and >6% nitrogen dioxide

MW: —	*VP:* 62 mmHg (77°F)	*FlP: NA*
D: 1.5 g/mL	*VD:* 2.2	*LEL:* NA
MP: –44°F	*Vlt:* 82,000 ppm (77°F)	*UEL*: NA
BP: 252°F	*ER:* 550	*RP:* 0.2
Vsc: 0.51 cS	*H_2O:* Miscible (reacts)	*IP:* 11.95 eV (nitric acid)
	Sol: Ether	*IP:* 9.75 eV (nitrogen dioxide)

C11-A127

Nitric Oxide

CAS: 10102-43-9
RTECS: QX0525000
UN: 1660; 124
EC: 233-271-0
UNII: 31C4KY9ESH
ICD-11: XM4HQ2

NO

Colorless gas that becomes reddish-brown in high concentrations. It has a sharp, suffocating, sweet odor. It is rapidly converted in air to Nitrogen dioxide (C11-A128). This material is hazardous through inhalation and produces local skin/eye impacts. Causes eye, and respiratory irritation with difficulty breathing (dyspnea) and central nervous system depression. Can oxidize hemoglobin so it can no longer transport oxygen (methemoglobinemia).

Used industrially for the manufacture of nitric acid and nitrosyl carbonyls; in the bleaching of rayon; as a stabilizer for propylene, and methyl ether; and as a medication.

DHS Chemicals of Interest list, Australia Chemicals of Security Concern list, ITF-25 Low Threat list, and NRL Critical Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 1.23 mg/m^3 at 77°F
PAC-1: 0.50 ppm; *PAC-2:* 12 ppm; *PAC-3:* 20 ppm
PEL: 25 ppm
REL: 25 ppm
TLV: 25 ppm
IDLH: 100 ppm

Final AEGLs

AEGL values for Nitrogen dioxide (C11-A128) should be used for emergency planning. Short-term exposures below 80 ppm of nitric oxide should not constitute a health hazard.

Properties:

MW: 30.0	*VP:* 26,000 mmHg	*FlP:* NA
D: 1.0 g/mL (liq. gas, –166°F)	*VD:* 1.0	*LEL:* NA
MP: –258°F	*Vlt:* NA	*UEL*: NA
BP: –241°F	*ER:* 450	*RP:* NA
Vsc: 0.05 cS (liq. gas, –148° F)	*H_2O:* 4.6%	*IP:* 9.27 eV
	Sol: Alcohols, carbon disulfide	

C11-A128

Nitrogen Dioxide

CAS: 10102-44-0
RTECS: QW9800000
UN: 1067; 124
EC: 233-272-6
UNII: S7G510RUBH
ICD-11: XM05F4

NO_2

Amber liquid to reddish-brown gas with a pungent, acrid, suffocating odor detectable at ≥1.1 ppm. A strong oxidizing agent that accelerates combustion. This material is hazardous through inhalation, and ingestion, and produces local skin/eye impacts. Contact produces first- and second-degree burns, severe eye irritation. Severe respiratory irritant with difficulty breathing (dyspnea), blue skin and lips (cyanosis), and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed. Nonirritating concentration may cause pulmonary edema.

Used industrially for the production of nitric acid and as a nitrating agent, oxidizing agent, polymerization inhibitor for acrylates, and as an oxidizer for rocket fuels.

DHS Chemicals of Interest list, ITF-25 Medium Threat list, and NRL High Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 1.88 mg/m^3 at 77°F
Eye Irritation: 11 ppm; exposure duration unspecified
MEG$_{(1hr)}$: Neg: 0.50 ppm; Mar: 12 ppm; Crit: 20 ppm; Cat: —
PAC-1: 0.50 ppm; *PAC-2:* 12 ppm; *PAC-3:* 20 ppm
TLV: 0.2 ppm
Ceiling$_{(OSHA)}$: 5 ppm
STEL$_{(NIOSH)}$: 1 ppm
IDLH: 13 ppm

Final AEGLs
AEGL-1: 1 hr – 0.50 ppm; 4 hr – 0.50 ppm; 8 hr – 0.50 ppm
AEGL-2: 1 hr – 12 ppm; 4 hr – 8.2 ppm; 8 hr – 6.7 ppm
AEGL-3: 1 hr – 20 ppm; 4 hr – 14 ppm; 8 hr – 11 ppm

Properties:

MW: 46.0	*VP:* 720 mmHg	*FlP:* NA
D: 1.4 g/mL (liq. gas)	*VD:* 1.6	*LEL:* NA
MP: 12°F	*Vlt:* —	*UEL*: NA
BP: 70°F	*ER:* 730	*RP:* NA
Vsc: 0.29 cS (liq. gas, 68° F)	*H_2O:* Reacts	*IP:* 9.75 eV
	Sol: Concentrated nitric acid	

C11-A129

Nitrogen Trifluoride

CAS: 7783-54-2
RTECS: QX1925000
UN: 2451; 122
EC: 232-007-1
UNII: 4402F4X0RH
ICD-11: —

NF_3

Colorless gas that is odorless. Impurities can give it a pungent, musty or moldy odor. A strong oxidizing agent that accelerates combustion. This material is hazardous through inhalation. Effects in humans are not well documented. Based on animal studies, likely respiratory irritation with difficulty breathing (dyspnea), blue skin and lips (cyanosis), and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed. Possibility of oxidization of hemoglobin so it can no longer transport oxygen (methemoglobinemia).

Used industrially in high energy lasers, as an oxidizer for high-energy fuels, as a source of fluorine, and for chemical synthesis.

This material is on the NRL Critical Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 2.90 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 200 ppm; Mar: 520 ppm; Crit: 860 ppm; Cat: —
PAC-1: 200 ppm; *PAC-2:* 517 ppm; *PAC-3:* 860 ppm
PEL: 10 ppm
REL: 10 ppm
TLV: 10 ppm
IDLH: 1,000 ppm

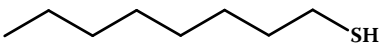
Interim AEGLs
AEGL-1: 1 hr – 200 ppm; 4 hr – 50 ppm; 8 hr – 25 ppm
AEGL-2: 1 hr – 530 ppm; 4 hr – 140 ppm; 8 hr – 68 ppm
AEGL-3: 1 hr – 860 ppm; 4 hr – 220 ppm; 8 hr – 110 ppm

Properties:

MW: 71.0	*VP:* 33,400 mmHg (–40°F)	*FlP:* NA
D: 1.5 g/mL (liq. gas)	*VD:* 2.5	*LEL:* NA
MP: –344°F	*Vlt:* NA	*UEL*: NA
BP: –200°F	*ER:* 250	*RP:* NA
Vsc: 0.012 cS	*H_2O:* 0.0061% (reacts)	*IP:* 12.97 eV
	Sol: —	

C11-A130

Octyl Mercaptan
CAS: 111-88-6
RTECS: —
UN: —
EC: 203-918-1
UNII: 42GO2PA46L
ICD-11: —



C_8 H_{18} S

Colorless to pale-yellow liquid with a mild odor. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts. Causes irritation of the skin, eyes and respiratory system with blue skin and lips (cyanosis), and central nervous system depression.

Used industrially as a polymerization conditioner and as an intermediate in organic synthesis.

This material is on the ITF-25 Medium Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 5.98 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.067 ppm; Mar: 0.50 ppm; Crit: 130 ppm; Cat: —
PAC-1: 0.045 ppm; *PAC-2:* 0.50 ppm; *PAC-3:* 67 ppm
$Ceiling_{(NIOSH)}$: 0.5 ppm

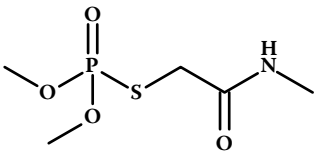
Properties:

MW: 146.3	*VP:* 0.4245 mmHg (77°F)	*FlP:* 154°F
D: 0.84 g/mL	*VD:* 5.0	*LEL:* 0.8%
MP: –57°F	*Vlt:* 560 ppm (77°F)	*UEL*: —
BP: 390°F	*ER:* —	*RP:* 20
Vsc: 0.52 cS	*H_2O:* Insoluble	*IP:* —
	Sol: Ethanol, ether, acetone	

C11-A131

Omethoate

CAS: 1113-02-6
RTECS: TF8050000
UN: —
EC: 214-197-8
UNII: 28U28EWE79
ICD-11: XM2D86



$C_5\ H_{12}\ N\ O_4\ P\ S$

Colorless to yellowish oily liquid with a mercaptan-like odor. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. It is a cholinesterase inhibitor.

Used industrially as an acaricide and insecticide.

This material is the Australia Chemicals of Security Concern list.

Exposure Hazards

Conversion Factor: 1 ppm = 8.72 mg/m^3 at 77°F

Human toxicity values have not been established or have not been published.

Properties:

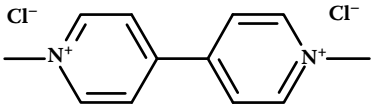
MW: 213.2	*VP:* 2.48×10^{-5} mmHg (77°F)	*FlP:* 212°F
D: 1.3 g/mL	*VD:* 7.3	*LEL:* —
MP: –18°F	*Vlt:* —	*UEL*: —
BP: Decomposes	*ER:* —	*RP:* —
Vsc: —	*H_2O:* 100%	*IP:* —
	Sol: Dichloromethane, toluene, alcohols, acetone	

C11-A132

Paraquat Dichloride

CAS: 1910-42-5; 4685-14-7 (Free base)
RTECS: DW2275000; DW1960000 (Free base)

UN: —
EC: 217-615-7; 225-141-7 (Free base)
UNII: 2KZ83GSS73; PLG39H7695 (Free base)
ICD-11: XM4SL8



C_{12} H_{14} N_2· Cl2

Colorless, white, or pale yellow, hygroscopic crystalline solid with a faint ammonia-like odor. Commercial material is a dark red solution. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Causes severe eye and respiratory irritation with mild skin irritation. Effects include headache and nose bleeds (epistaxis).

Used industrially as an herbicide.

This material is on the FBI list and Australia Chemicals of Security Concern list.

Exposure Hazards

Conversion Factor: 1 ppm = 7.61 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 1.5 mg/m^3; Mar: 13 mg/m^3; Crit: 150 mg/m^3; Cat: —
PAC-1: 0.30 mg/m^3; *PAC-2:* 4.4 mg/m^3; *PAC-3:* 26 mg/m^3
PEL: 0.5 mg/m^3
REL: 0.1 mg/m^3
TLV: 0.05 mg/m^3 [Skin] (as free base)
IDLH: 1 mg/m^3

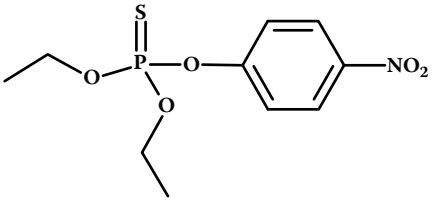
Properties:

MW: 257.2	*VP:* 8×10^{-7} mmHg	*FlP:* NA
D: 1.2 g/cm^3	*VD:* —	*LEL:* NA
MP: Decomposes	*Vlt:* —	*UEL*: NA
BP: NA	*ER:* —	*RP:* —
Vsc: —	*H_2O:* Miscible	*IP:* —
	Sol: —	

C11-A133

Parathion

CAS: 56-38-2
RTECS: TF4550000
UN: —
EC: 200-271-7
UNII: 61G466064D
ICD-11: XM14N6



$C_{10}\ H_{14}\ N\ O_5\ P\ S$

Pale-yellow to dark-brown liquid with a faint odor like garlic detectable at ≥0.04 ppm (0.476 mg/m^3). Odor becomes more pronounced during storage. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. It is a cholinesterase inhibitor.

Used industrially as an insecticide and acaricide.

This material is on the FBI list and NRL Critical Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 11.91 mg/m^3 at 77°F
$LD_{50\ (Ing)}$: 0.210 g
$MEG_{(1hr)}$: Neg: 0.31 mg/m^3; Mar: 1.5 mg/m^3; Crit: 2.0 mg/m^3; Cat: —
PAC-1: 0.15 mg/m^3; *PAC-2:* 1.5 mg/m^3; *PAC-3:* 2.0 mg/m^3
PEL: 0.1 mg/m^3 [Skin]
REL: 0.05 mg/m^3 [Skin]
TLV: 0.05 mg/m^3 [Skin]
IDLH: 10 mg/m^3 [Skin]

Interim AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 1.5 mg/m^3; 4 hr – 0.96 mg/m^3; 8 hr – 0.48 mg/m^3
AEGL-3: 1 hr – 2.0 mg/m^3; 4 hr – 1.3 mg/m^3; 8 hr – 0.63 mg/m^3

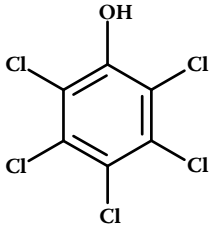
Properties:

MW: 291.3	*VP:* 6.68 × 10^{-6} mmHg	*FlP:* 248°F
D: 1.3 g/mL (77°F)	*VD:* 10	*LEL:* —
MP: 43°F	*Vlt:* 0.01 ppm	*UEL:* —
BP: 707°F	*ER:* —	*RP:* —
Vsc: 12 cS (77°F)	*H_2O:* 0.0011%	*IP:* —
	Sol: Most organic solvents	

C11-A134

Pentachlorophenol

CAS: 87-86-5, 131-52-2 (Sodium salt)
RTECS: SM6300000; SM6490000 (Sodium salt)
UN: 3155; 154
EC: 201-778-6; 205-025-2 (Sodium salt)
UNII: D9BSU0SE4T; 640L8FZO38 (Sodium salt)
ICD-11: XM32P2



C_6 H Cl_5 O

White crystalline solid with a benzene-like odor. Commercial material may be dark gray to brown. Various salts have been reported. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Causes severe eye with tearing (lacrimation); skin irritation with rashes and blisters (vesiculation); and respiratory irritation with difficulty breathing (dyspnea). Central nervous system effects include headache, dizziness, and weakness (lassitude).

Used industrially as a fungicide and wood preservative.

This material is on the NRL Critical Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 10.90 mg/m^3 at 77°F
Eye & Respiratory Irritation: 1 mg/m^3 for naïve individuals; 2.4 mg/m^3 for conditioned individuals
$MEG_{(1hr)}$: Neg: —; Mar: —; Crit: 2.5 mg/m^3; Cat: —
PAC-1: 1.0 mg/m^3; *PAC-2:* 15 mg/m^3; *PAC-3:* 150 mg/m^3
PEL: 0.5 mg/m^3 [Skin]
REL: 0.5 mg/m^3 [Skin]
TLV: 0.5 mg/m^3 [Skin]
$STEL_{(ACGIH)}$: 1 mg/m^3 [Skin]
IDLH: 2.5 mg/m^3 [Skin]

Properties:

MW: 266.4	*VP:* 1×10^{-4} mmHg (77°F)	*FlP:* NA
D: 2.0 g/cm^3	*VD:* 9.2	*LEL:* NA
MP: 374°F	*Vlt:* —	*UEL*: NA
BP: Decomposes	*ER:* —	*RP:* 62,000
Vsc: —	*H_2O:* 0.001%	*IP:* —
	Sol: Alcohol, ether, benzene	

Sodium Salt

MW: 288.3
D: 1.8 g/cm^3
MP: >572°F
H_2O: 2.2%

C11-A135

Perchloric Acid

CAS: 7601-90-3
RTECS: SC7500000
UN: 1873 (>50% but ≤72% Acid); 143 / 1802 (≤50% Acid); 140

EC: 231-512-4
UNII: V561V90BG2
ICD-11: —

$HClO_4$

Colorless, oily, fuming, hygroscopic liquid. Various salts (solids) have been reported. Forms explosive mixtures with many materials and may spontaneously deflagrate in contact with combustibles. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts. Violent irritant; contact produces first- and second-degree burns, severe eye and respiratory irritation with difficulty breathing (dyspnea), and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed.

Used industrially in the manufacture of explosives and rocket fuels, for plating metals and as an analytical reagent.

This material is on the Australia Chemicals of Security Concern list.

Exposure Hazards

Conversion Factor: 1 ppm = 4.11 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 3.2 ppm; Mar: 24 ppm; Crit: 120 ppm; Cat: —
PAC-1: 0.61 ppm; *PAC-2:* 6.8 ppm; *PAC-3:* 41 ppm

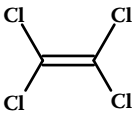
Properties: (for 70% acid)

MW: 100.5	*VP:* 6.8 mmHg	*FlP:* NA
D: 1.7 g/mL	*VD:* 3.5	*LEL:* NA
MP: –0.4°F	*Vlt:* 8,900 ppm	*UEL*: NA
BP: 397°F	*ER:* —	*RP:* 1.48
Vsc: —	*H_2O:* Miscible	*IP:* —
	Sol: —	

C11-A136

Perchloroethylene

CAS: 127-18-4
RTECS: KX3850000
UN: 1897; 160
EC: 204-825-9
UNII: TJ904HH8SN
ICD-11: XM3DA8; XM86D7 (Vapor)



$C_2\ Cl_4$

Colorless, volatile liquid with a chloroform-like odor detectable at ≥4.7 ppm. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Causes skin, eye, and respiratory irritation with central nervous system depression leading to unconsciousness (anesthesia).

Used industrially as a solvent for dry-cleaning, as a degreasing agent, and in the manufacture of fluorocarbons.

This material is on the NRL Critical Threat list.

This material has been used as a simulant in government tests.

Exposure Hazards

Conversion Factor: 1 ppm = 6.78 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 35 ppm; Mar: 240 ppm; Crit: 1,200 ppm; Cat: —
PAC-1: 35 ppm; *PAC-2:* 240 ppm; *PAC-3:* 1,200 ppm
PEL: 100 ppm
TLV: 25 ppm
$STEL_{(ACGIH)}$: 100 ppm
$Ceiling_{(OSHA)}$: 200 ppm (maximum peak 300 ppm)
IDLH: 150 ppm

Interim AEGLs
AEGL-1: 1 hr – 35 ppm; 4 hr – 35 ppm; 8 hr – 35 ppm
AEGL-2: 1 hr – 230 ppm; 4 hr – 120 ppm; 8 hr – 81 ppm
AEGL-3: 1 hr – 1,200 ppm; 4 hr – 580 ppm; 8 hr – 410 ppm

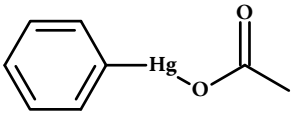
Properties:

MW: 165.8	*VP:* 14 mmHg	*FlP:* NA
D: 1.6 g/mL	*VD:* 5.7	*LEL:* NA
MP: –2°F	*Vlt:* 19,000 ppm	*UEL*: NA
BP: 250°F	*ER:* —	*RP:* 0.55
Vsc: 0.56 cS	*H_2O:* 0.02%	*IP:* 9.32 eV
	Sol: —	

C11-A137

Phenylmercury Acetate

CAS: 62-38-4
RTECS: OV6475000
UN: 1674; 151
EC: 200-532-5
UNII: OSX88361UX
ICD-11: XM2Z22



C_8 H_8 Hg O_2

White to cream-white, hygroscopic crystalline material. Odorless when pure, impurities may give it a slight vinegar odor. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Contact produces first- and second-degree burns, severe eye irritation. Severe respiratory irritant with difficulty breathing (dyspnea).

Used industrially as a disinfectant, paint preservative, mildewcide and herbicide.

This material is on the FBI list.

Exposure Hazards

Conversion Factor: 1 ppm = 13.77 mg/m^3 at 77°F
$LD_{50\ (Ing)}$: 0.35 g – 3.5 g
$MEG_{(1hr)}$: Neg: —; Mar: —; Crit: 17 mg/m^3; Cat: —
PAC-1: 2.0 mg/m^3; *PAC-2:* 22 mg/m^3; *PAC-3:* 47 mg/m^3

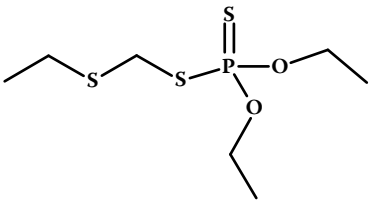
Properties:

MW: 336.7	*VP:* 1.2 × 10^{-4} mmHg (77°F)	*FlP:* 140°F
D: 0.24 g/cm^3 (est.)	*VD:* 12	*LEL:* —
MP: 300°F	*Vlt:* —	*UEL:* —
BP: —	*ER:* —	*RP:* 46,000
Vsc: —	*H_2O:* 0.6%	*IP:* —
	Sol: Acetone, alcohol, acetic acid	

C11-A138

Phorate

CAS: 298-02-2
RTECS: TD9450000
UN: —
EC: 206-052-2
UNII: 3W54X3W9IV
ICD-11: XM20V2



$C_7\ H_{17}\ O_2\ P\ S_3$

Colorless to light yellow liquid with a skunk-like odor. Commercial material may be light brown. This material is hazardous through inhalation, skin absorption, and ingestion, and produces local skin/eye impacts. It is a cholinesterase inhibitor.

Used industrially as an insecticide and acaricide.

This material is on the FBI list and Australia Chemicals of Security Concern list.

Exposure Hazards

Conversion Factor: 1 ppm = 10.65 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: —; Mar: 0.042 mg/m^3; Crit: 0.12 mg/m^3; Cat: —
PAC-1: 0.0036 mg/m^3; *PAC-2:* 0.040 mg/m^3; *PAC-3:* 0.12 mg/m^3
REL: 0.05 mg/m^3 [Skin]
TLV: 0.05 mg/m^3 [Skin]
$STEL_{(NIOSH)}$: 0.2 mg/m^3 [Skin]

Interim AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 0.040 mg/m^3; 4 hr – 0.010 mg/m^3; 8 hr – 0.0050 mg/m^3
AEGL-3: 1 hr – 0.12 mg/m^3; 4 hr – 0.031 mg/m^3; 8 hr – 0.015 mg/m^3

Properties:

MW: 260.4	*VP:* 7.5 × 10^{-4} mmHg	*FlP:* 320°F
D: 1.2 g/mL (77°F)	*VD:* 9.0	*LEL:* —
MP: –45°F	*Vlt:* —	*UEL*: —
BP: 257°F (2 mmHg)	*ER:* —	*RP:* 9,600
Vsc: —	*H_2O:* 0.005% (decomposes slowly)	*IP:* —
	Sol: Most organic solvents	

C11-A139

Phosphine
CAS: 7803-51-2
RTECS: SY7525000
UN: 2199; 119 / 3525; 173 (Absorbed)
EC: 232-260-8
UNII: FW6947296I
ICD-11: XM3G46

PH_3
Colorless gas that is odorless when pure; otherwise, an odor like garlic or decaying fish that is detectable at ≥0.03 ppm. May spontaneously ignite in air if traces of diphosphorous hydride (P_2H_2) are present. This material is hazardous through inhalation. Respiratory irritation with difficulty breathing (dyspnea) and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed. Produces central nervous system depression with convulsions and unconsciousness.

Used industrially as a fumigant, doping agent for semiconductors, and intermediate for preparation of some flame retardants.

Phosphine is generated when phosphide salts (e.g., aluminum phosphide, calcium phosphide, magnesium phosphide, magnesium aluminum phosphide, potassium phosphide, sodium phosphide, stannic phosphide, strontium phosphide, zinc phosphide) come into contact with water or acids.

This material is on the DHS Chemicals of Interest list, FBI list, Australia Chemicals of Security Concern list, ITF-25 Medium Threat list, and NRL Critical Threat list.

Exposure Hazards
Conversion Factor: 1 ppm = 1.39 mg/m^3 at 77°F
$LC_{50\ (Inh)}$: 500 ppm for a 30-minute exposure
$LC_{50\ (Inh)}$: 1,000 ppm, after only a few breaths
$MEG_{(1hr)}$: Neg: 0.94 ppm; Mar: 2.0 ppm; Crit: 3.6 ppm; Cat: —
PAC-1: 1.0 ppm; *PAC-2:* 2.0 ppm; *PAC-3:* 3.6 ppm
PEL: 0.3 ppm
REL: 0.3 ppm
TLV: 0.05 ppm
$STEL_{(NIOSH)}$: 1 ppm

Ceiling$_{(ACGIH)}$: 0.15 ppm
IDLH: 50 ppm

Final AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 2.0 ppm; 4 hr – 0.50 ppm; 8 hr – 0.25 ppm
AEGL-3: 1 hr – 3.6 ppm; 4 hr – 0.90 ppm; 8 hr – 0.45 ppm

Properties:

MW: 34.0	*VP:* 31,400 mmHg	*FlP:* —
D: 0.49 g/mL (liq. gas, 77°F)	*VD:* 1.2	*LEL:* 1.8%
MP: –207°F	*Vlt:* NA	*UEL*: 98%
BP: –126°F	*ER:* 350	*RP:* NA
Vsc: 0.071 cS (liq. gas, 77°F)	*H_2O:* Slight	*IP:* 9.96 eV
	Sol: Alcohols, ether	

C11-A140

Phosphorus Pentafluoride
CAS: 7647-19-0
RTECS: TH4070000
UN: 2198; 125 / 3524; 173 (Absorbed)
EC: 231-602-3
UNII: 0OU1ESO71L
ICD-11: —

PF_5
Colorless gas with an unpleasant odor that fumes in contact with air. This material is hazardous through inhalation and produces local skin/eye impacts. Causes severe skin, eye, and respiratory irritation with difficulty breathing (dyspnea) and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed.

Used industrially as a catalyst in ionic polymerizations, mild fluorinating agent; used in the manufacture of semiconductors.

This material is on the ITF-25 Medium Threat list.

Exposure Hazards
Conversion Factor: 1 ppm = 5.15 mg/m^3 at 77°F
MEG$_{(1hr)}$: Neg: 1.9 ppm; Mar: 2.9 ppm; Crit: 58 ppm; Cat: —
PAC-1: 1.9 ppm; *PAC-2:* 21 ppm; *PAC-3:* 130 ppm

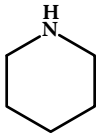
Properties:

MW: 126.0	*VP:* 21,432 mmHg (70°F)	*FlP:* NA
D: 1.1 g/mL (liq. gas, 32°F)	*VD:* 4.3	*LEL:* NA
MP: –137°F	*Vlt:* NA	*UEL*: NA
BP: –120°F	*ER:* 200	*RP:* NA
Vsc: 0.16 cS (liq. gas, –4°F)	*H_2O:* Reacts violently	*IP:* 15.54 eV
	Sol: —	

C11-A141

Piperidine

CAS: 110-89-4
RTECS: TM3500000
UN: 2401; 132
EC: 203-813-0
UNII: 67I85E138Y
ICD-11: XM5KD3



$C_5\ H_{11}\ N$

Clear colorless liquid with an ammonia or pepper-like odor detectable at ≥0.4 ppm. Various salts (solids) have been reported. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Causes severe skin, eye, and respiratory irritation with difficulty breathing (dyspnea) and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed.

Used industrially as a flavoring agent, solvent, intermediate for pharmaceuticals and other chemicals, and an ingredient in fuels and oils.

This material is on the DHS Chemicals of Interest list.

This material has been used as a simulant in government tests.

Exposure Hazards

Conversion Factor: 1 ppm = 3.48 mg/m^3 at 77°F
Unbearable Odor 5 ppm; naïve individuals, exposure duration unspecified
Intolerable Irritation: 26 ppm; exposure duration unspecified
MEG$_{(1hr)}$: Neg: 6.6 ppm; Mar: 32 ppm; Crit: 110 ppm; Cat: —
PAC-1: 6.6 ppm; *PAC-2:* 32 ppm; *PAC-3:* 110 ppm
WEEL: 1 ppm [Skin]

Final AEGLs
AEGL-1: 1 hr – 6.6 ppm; 4 hr – 2.6 ppm; 8 hr – 1.7 ppm
AEGL-2: 1 hr – 33 ppm; 4 hr – 13 ppm; 8 hr – 8.3 ppm
AEGL-3: 1 hr – 110 ppm; 4 hr – 45 ppm; 8 hr – 28 ppm

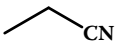
Properties:

MW: 85.2	*VP:* 33.1 mmHg (77°F)	*FlP:* 61°F
D: 0.86 g/mL	*VD: 2.9*	*LEL:* 1.5%
MP: 19°F	*Vlt:* 43,000 ppm	*UEL*: 10.3%
BP: 223°F	*ER:* —	*RP:* 0.33
Vsc: 1.7 cS	*H_2O:* Miscible	*IP:* 8.7 eV
	Sol: Ethanol, ether, acetone	

C11-A142

Propionitrile

CAS: 107-12-0
RTECS: UF9625000
UN: 2404; 131
EC: 203-464-4
UNII: E16N05FX3S
ICD-11: —



C_3 H_5 N

Colorless liquid with a pleasant, sweetish, ethereal odor. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Forms cyanide in the body. Effects include central nervous system depression, with skin, eye, and respiratory irritation and difficulty breathing (dyspnea).

Used industrially as a solvent and intermediate for other chemicals.

This material is on the DHS Chemicals of Interest list.

Exposure Hazards

Conversion Factor: 1 ppm = 2.25 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 5.8 ppm; Mar: 7.1 ppm; Crit: 37 ppm; Cat: —
PAC-1: 0.28 ppm; *PAC-2:* 3.0 ppm; *PAC-3:* 8.9 ppm
REL: 6 ppm

Final AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 3.0 ppm; 4 hr – 1.9 ppm; 8 hr – 1.3 ppm
AEGL-3: 1 hr – 9.1 ppm; 4 hr – 5.7 ppm; 8 hr – 3.8 ppm

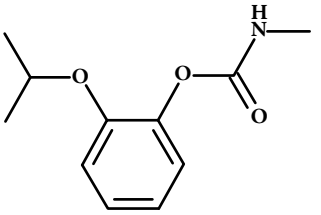
Properties:

MW: 55.1	*VP:* 38 mmHg	*FlP:* 36°F
D: 0.78 g/mL	*VD:* 1.9	*LEL:* 3.1%
MP: –133°F	*Vlt:* 51,000 ppm	*UEL*: 14%
BP: 207°F	*ER:* —	*RP:* 0.35
Vsc: 0.56 cS	*H_2O:* 11.9%	*IP:* 11.84 eV
	Sol: Miscible in ether, alcohol	

C11-A143

Propoxur

CAS: 114-26-1
RTECS: FC3150000
UN: —
EC: 204-043-8
UNII: BFH029TL73
ICD-11: XM79F9



C_{11} H_{15} N O_3

White to tan, crystalline solid with no odor. Commercial material may have a faint aromatic odor. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. It is a cholinesterase inhibitor.

Used industrially as an insecticide and acaricide.

This material is on the Australia Chemicals of Security Concern list.

Exposure Hazards

Conversion Factor: 1 ppm = 8.56 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 1.5 mg/m^3; Mar: —; Crit: 20 mg/m^3; Cat: —
PAC-1: 1.5 mg/m^3; *PAC-2:* 6.7 mg/m^3; *PAC-3:* 40 mg/m^3
REL: 0.5 mg/m^3
TLV: 0.5 mg/m^3

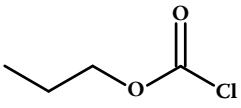
Properties:

MW: 209.2	*VP:* 7×10^{-6} mmHg	*FlP:* —
D: 1.1 g/cm^3	*VD:* 7.2	*LEL:* —
MP: 189°F	*Vlt:* —	*UEL:* —
BP: Decomposes	*ER:* —	*RP:* —
Vsc: —	*H_2O:* 0.18% (86°F)	*IP:* —
	Sol: Alcohols, acetone	

C11-A144

Propyl Chloroformate

CAS: 109-61-5
RTECS: LQ6830000
UN: 2740; 155
EC: 203-687-7
UNII: A5Y2T003JU
ICD-11: —



C_4 H_7 Cl O_2

Colorless to pale-yellow liquid. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Contact produces first- and second-degree burns, severe eye irritation with tearing (lacrimation). Severe respiratory irritant with difficulty breathing (dyspnea) and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed.

Used industrially as an intermediate to initiate polymerization and synthesize other chemicals.

This material is on the DHS Chemicals of Interest list and ITF-25 Low Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 5.01 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 2.0 ppm; Mar: 3.8 ppm; Crit: 11 ppm; Cat: —
PAC-1: 0.34 ppm; *PAC-2:* 3.8 ppm; *PAC-3:* 11 ppm

Final AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 3.7 ppm; 4 hr – 0.90 ppm; 8 hr – 0.47 ppm
AEGL-3: 1 hr – 11 ppm; 4 hr – 2.7 ppm; 8 hr – 1.4 ppm

Properties:

MW: 122.6	*VP:* 19.5 mmHg	*FlP:* 79°F
D: 1.1 g/mL	*VD:* 4.2	*LEL:* —
MP: —	*Vlt:* 26,000 ppm (77°F)	*UEL:* —
BP: 238°F	*ER:* —	*RP:* 0.46
Vsc: 0.73 cS	*H_2O:* Insoluble (decomposes slowly)	*IP:* —
	Sol: Benzene, chloroform, ether	

C11-A145

Propylene Imine

CAS: 75-55-8
RTECS: CM8050000
UN: 1921; 131P
EC: 200-878-7
UNII: ULC972Q7TZ
ICD-11: —



$C_3\ H_7\ N$

Colorless, oily liquid with a pungent ammonia-like odor. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Causes severe skin, eye, and respiratory irritation with difficulty breathing (dyspnea) and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed.

Used industrially as a chemical intermediate in the paper, textile, rubber, and pharmaceutical industries.

This material is on the DHS Chemicals of Interest list.

Exposure Hazards

Conversion Factor: 1 ppm = 2.34 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.32 ppm; Mar: 12 ppm; Crit: 23 ppm; Cat: —
PAC-1: 0.40 ppm; *PAC-2:* 12 ppm; *PAC-3:* 23 ppm

PEL: 2 ppm [Skin]
REL: 2 ppm [Skin]
TLV: 0.2 ppm [Skin]
$STEL_{(ACGIH)}$: 0.4 ppm [Skin]
IDLH: 100 ppm [Skin]

Final AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 12 ppm; 4 hr – 2.5 ppm; 8 hr – 1.2 ppm
AEGL-3: 1 hr – 23 ppm; 4 hr – 5.1 ppm; 8 hr – 2.4 ppm

Properties:

MW: 57.1	*VP:* 112 mmHg	*FlP:* 25°F
D: 0.80 g/mL (77°F)	*VD:* 2.0	*LEL:* —
MP: −85°F	*Vlt:* 180,000 ppm	*UEL*: —
BP: 153°F	*ER:* 340	*RP:* 0.1
Vsc: 0.61 cS (77°F)	*H_2O:* Miscible	*IP:* 9.00 eV
	Sol: Most organic solvents	

C11-A146

Osmium Tetroxide
CAS: 20816-12-0
RTECS: RN1140000
UN: 2471; 154
EC: 244-058-7
UNII: P40W033BGM
ICD-11: —

OsO_4
Colorless to pale-yellow crystalline solid with a pungent, chlorine-like odor that is detectable at ≥0.0019 ppm. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts. Contact produces first- and second-degree burns, severe eye irritation with tearing (lacrimation). Severe respiratory irritant with difficulty breathing (dyspnea) and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed.

Used industrially as an oxidizing agent especially in conversion of olefins to glycols, and in the preparation of chlorates, peroxides, and periodates; as a biological stain for adipose tissues; and agriculturally as a micronutrient in soil for optimum microbial fixation of nitrogen.

This material is on the FBI list and Australia Chemicals of Security Concern list.

Exposure Hazards
Conversion Factor: 1 ppm = 10.40 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.00058 ppm; Mar: 0.0084 ppm; Crit: 4.0 ppm; Cat: —
PAC-1: 0.00060 ppm; *PAC-2:* 0.0083 ppm; *PAC-3:* 4.0 ppm
PEL: 0.0002 ppm
TLV: 0.0002 ppm (as osmium)
$STEL_{(ACGIH)}$:0.0006 ppm (as osmium)
$STEL_{(NIOSH)}$: 0.0006 ppm
IDLH: 0.1 ppm

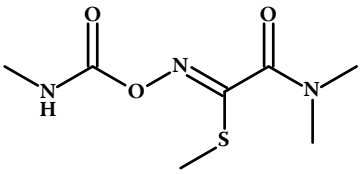
Interim AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 0.0084 ppm; 4 hr – 0.0033 ppm; 8 hr – 0.0017 ppm
AEGL-3: 1 hr – 4.0 ppm; 4 hr – 2.5 ppm; 8 hr – 2.0 ppm

Properties:

MW: 254.2	*VP:* 6.98 mmHg	*FlP:* NA
D: 5.1 g/cm^3	*VP:* 11 mmHg (81°F)	*LEL:* NA
MP: 105°F	*VD:* 8.8	*UEL*: NA
BP: Sublimes	*Vlt:* 12,000 ppm (77°F)	*RP:* 8.9
Vsc: —	*ER:* —	*IP:* 12.35 eV
	H_2O: 6% (77°F)	
	Sol: Benzene, alcohol, ether	

C11-A147

Oxamyl
CAS: 23135-22-0
RTECS: RP2300000
UN: —
EC: 245-445-3
UNII: SWV4D62X9E
ICD-11: XM0DL6



$C_7\ H_{13}\ N_3\ O_3\ S$

Colorless to white crystalline solid with a slight sulfurous or garlic-like odor. Upon initial melting, it morphs to a secondary crystalline form with a new, higher melting point. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. It is a cholinesterase inhibitor.

Used industrially as an insecticide, nematicide and acaricide.

This material is the Australia Chemicals of Security Concern list.

Exposure Hazards
Conversion Factor: 1 ppm = 8.97 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 1.2 mg/m^3; Mar: 1.8 mg/m^3; Crit: 5.3 mg/m^3; Cat: —
PAC-1: 0.15 mg/m^3; *PAC-2:* 1.7 mg/m^3; *PAC-3:* 4.7 mg/m^3

Proposed AEGLs
AEGL-1: 1 hr – 1.2 mg/m^3; 4 hr – 0.49 mg/m^3; 8 hr – 0.32 mg/m^3
AEGL-2: 1 hr – 1.8 mg/m^3; 4 hr – 0.73 mg/m^3; 8 hr – 0.47 mg/m^3
AEGL-3: 1 hr – 5.3 mg/m^3; 4 hr – 2.2 mg/m^3; 8 hr – 1.4 mg/m^3

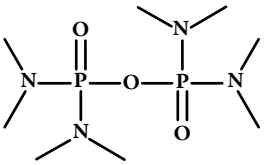
Properties:

MW: 219.3	*VP:* 2.3×10^{-4} mm Hg (77°F)	*FlP:* —
D: 0.97 g/cm^3 (77°F)	*VD:* 7.6	*LEL:* —
MP: 212°F – 216°F	*Vlt:* —	*UEL*: —
MP: 226°F–230°F (2nd crystalline form)	*ER:* —	*RP:* 30,000
BP: Decomposes	*H_2O:* 28% (77°F)	*IP:* —
Vsc: —	*Sol:* Acetone, alcohols	

C11-A148

Schradan

CAS: 152-16-9
RTECS: UX5950000
UN: —
EC: 205-801-0
UNII: D77OYM46S1
ICD-11: XM0TB4



$C_8\ H_{24}\ N_4\ O_3\ P_2$

Colorless, viscous liquid. Commercial material is dark brown. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. It is a cholinesterase inhibitor.

Used as an agricultural systemic insecticide and acaricide.

This material is on the NRL High Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 11.71 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.50 mg/m^3; Mar: 0.80 mg/m^3; Crit: 3.5 mg/m^3; Cat: —
PAC-1: 0.073 mg/m^3; *PAC-2:* 0.80 mg/m^3; *PAC-3:* 4.9 mg/m^3

Properties:

MW: 286.3	*VP:* 0.001 mmHg (77°F)	*FlP:* —
D: 1.1 g/mL (77°F)	*VD:* 9.9	*LEL:* —
MP: 63°F	*Vlt:* 1.3 ppm (77°F)	*UEL*: —
BP: 248°F (0.5 mmHg)	*ER:* —	*RP:* 6,000
Vsc: —	*H_2O:* Miscible	*IP:* —
	Sol: Alcohols, ketones, chloroform	

C11-A149

Selenium Hexafluoride

CAS: 7783-79-1
RTECS: VS9450000
UN: 2194; 125
EC: —
UNII: H91D37I668
ICD-11: —

SeF_6

Colorless gas with a pungent odor. This material is hazardous through inhalation and produces local skin/eye impacts. Causes skin, eye, and respiratory irritation with difficulty breathing (dyspnea) and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed.

Used industrially as an electric insulator.

This material is on the DHS Chemicals of Interest list and ITF-25 Medium Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 7.89 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.053 ppm; Mar: 0.087 ppm; Crit: 0.27 ppm; Cat: —
PAC-1: 0.053 ppm; *PAC-2:* 0.087 ppm; *PAC-3:* 0.27 ppm
PEL: 0.05 ppm
REL: 0.05 ppm
TLV: 0.05 ppm (as selenium)
IDLH: 2 ppm

Interim AEGLs
AEGL-1: 1 hr – 0.053 ppm; 4 hr – 0.033 ppm; 8 hr – 0.017 ppm
AEGL-2: 1 hr – 0.087 ppm; 4 hr – 0.057 ppm; 8 hr – 0.028 ppm
AEGL-3: 1 hr – 0.26 ppm; 4 hr – 0.17 ppm; 8 hr – 0.083 ppm

Properties:

MW: 192.9	*VP:* 651.2 mmHg (–56°F)	*FlP:* NA
D: —	*VD:* 6.7	*LEL:* NA
MP: –52°F (Sublimes)	*Vlt:* NA	*UEL*: NA
BP: —	*ER:* —	*RP:* NA
Vsc: —	*H_2O:* Insoluble (decomposes)	*IP:* —
	Sol: —	

C11-A150

Silicon Tetrafluoride

CAS: 7783-61-1
RTECS: VW2327000
UN: 1859; 125 / 3521; 173 (Absorbed)
EC: 232-015-5
UNII: K60VCI56YO
ICD-11: —

SiF_4

Colorless gas that forms heavy clouds in moist air. It has a sharp, irritating and suffocating odor similar to hydrogen chloride. This material is hazardous through inhalation and produces local skin/eye impacts. Causes skin, eye, and respiratory irritation with difficulty breathing (dyspnea) and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed.

Used industrially for the manufacture of pure silicon, silane and fluosilicic acid; used to seal water out of oil wells during drillings.

This material is on the DHS Chemicals of Interest list, ITF-25 Medium Threat list, and NRL Critical Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 4.26 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.049 ppm; Mar: 3.3 ppm; Crit: 10 ppm; Cat: —
PAC-1: 0.049 ppm; *PAC-2:* 3.3 ppm; *PAC-3:* 10 ppm

Interim AEGLs
AEGL-1: 1 hr – 0.05 ppm; 4 hr – 0.05 ppm; 8 hr – 0.05 ppm
AEGL-2: 1 hr – 3.3 ppm; 4 hr – 0.87 ppm; 8 hr – 0.43 ppm
AEGL-3: 1 hr – 10 ppm; 4 hr – 2.6 ppm; 8 hr – 1.3 ppm

Properties:

MW: 104.1	*VP:* 70,000 mmHg (70°F; est.)	*FlP:* NA
D: 1.6 g/mL (liq. gas, –112°F)	*VD:* 3.6	*LEL:* NA
MP: Sublimes (–140°F)	*Vlt:* NA	*UEL*: NA
BP: —	*ER:* 240	*RP:* NA
Vsc: 0.4 cS (liq. gas, –58°F)	*H_2O:* Reacts	*IP:* 15.24 eV
	Sol: Absolute alcohol	

C11-A151

Sodium Arsenite

CAS: 7784-46-5
RTECS: CG3675000
UN: 2027; 151
EC: 232-070-5
UNII: 48OVY2OC72
ICD-11: XM7Y18

$NaAsO_2$

White or grayish-white powder that is somewhat hygroscopic. It absorbs carbon dioxide from the air. Technical grade is 90%–95% pure. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Causes skin, eye, and respiratory irritation with difficulty breathing (dyspnea). Symptoms may be delayed.

Used industrially as a fungicide, insecticide, herbicide, wood preservation, textile drying agent, corrosion inhibitor; as a veterinary medication; and in the manufacture of specialty soaps.

This material is on the FBI list.

Exposure Hazards

$MEG_{(1hr)}$: Neg: 1.3 mg/m^3; Mar: —; Crit: 8.7 mg/m^3; Cat: —
PAC-1: 0.91 mg/m^3; *PAC-2:* 10 mg/m^3; *PAC-3:* 170 mg/m^3

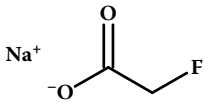
Properties:

MW: 129.9	*VP:* Negligible	*FlP:* —
D: 1.9 g/cm^3	*VD:* —	*LEL:* —
MP: 1,139°F	*Vlt:* NA	*UEL*: —
BP: —	*ER:* NA	*RP:* NA
Vsc: —	*H_2O:* Soluble	*IP:* —
	Sol: Slight in alcohol	

C11-A152

Sodium Fluoroacetate

CAS: 62-74-8
RTECS: AH9100000
UN: 2629; 151
EC: 200-548-2
UNII: 166WTM3843
ICD-11: XM9LE1



C_2 H_2 F O_2· Na

Colorless, white, or very pale-yellow hygroscopic powder that is odorless. Commercial material is sometimes dyed black. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Effects include difficulty breathing (dyspnea), blue skin and lips (cyanosis), irregular heartbeat (cardiac arrhythmias), and convulsions. Symptoms may be delayed.

Used industrially in poison baits to control rodents, wild pigs, and predators.

This material is on the FBI list and Australia Chemicals of Security Concern list.

Exposure Hazards

$MEG_{(1hr)}$: Neg: 0.15 mg/m^3; Mar: 0.50 mg/m^3; Crit: 2.5 mg/m^3; Cat: —
PAC-1: 0.15 mg/m^3; *PAC-2:* 0.50 mg/m^3; *PAC-3:* 5.0 mg/m^3
PEL: 0.05 mg/m^3 [Skin]
REL: 0.05 mg/m^3 [Skin]
TLV: 0.05 mg/m^3 [Skin]
$STEL_{(NIOSH)}$: 0.15 mg/m^3 [Skin]
IDLH: 2.5 mg/m^3 [Skin]

Properties:

MW: 100.0	*VP:* Negligible	*FlP:* NA
D: —	*VD:* —	*LEL:* NA
MP: 392°F (Decomposes)	*Vlt:* NA	*UEL*: NA

BP: —	*ER:* NA	*RP:* —
Vsc: —	*H_2O:* Miscible	*IP:* —
	Sol: Slight in methanol	

C11-A153

Stibine

CAS: 7803-52-3
RTECS: WJ0700000
UN: 2676; 119
EC: —
UNII: 0VKZ97K3UB
ICD-11: XM2AE9

H_3Sb

Colorless gas with a disagreeable odor similar to hydrogen sulfide (C07-A006). It decomposes slowly on standing, depositing elemental antimony. It is highly flammable. This material is hazardous through inhalation and produces local skin/eye impacts. Causes eye irritation and severe respiratory irritation with difficulty breathing (dyspnea), headache, and weakness (lassitude).

Used industrially in the manufacture of semiconductors, and as a fumigating agent. It may be a byproduct formed during charging of some lead storage batteries.

This material is on the DHS Chemicals of Interest list and ITF-25 Medium Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 5.10 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.20 ppm; Mar: 1.5 ppm; Crit: 9.6 ppm; Cat: —
PAC-1: 0.29 ppm; *PAC-2:* 1.5 ppm; *PAC-3:* 9.6 ppm
PEL: 0.1 ppm
REL: 0.1 ppm
TLV: 0.1 ppm
IDLH: 5 ppm

Interim AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 1.5 ppm; 4 hr – 0.36 ppm; 8 hr – 0.18 ppm
AEGL-3: 1 hr – 9.6 ppm; 4 hr – 2.4 ppm; 8 hr – 1.2 ppm

Properties:

MW: 124.8	*VP:* —	*FlP:* —
D: 2.2 g/mL (–1°F)	*VD:* 4.3	*LEL:* —
MP: –126°F	*Vlt:* —	*UEL*: —
BP: –1°F	*ER:* 370	*RP:* —
Vsc: —	*H_2O:* 0.41%	*IP:* 9.51 eV
	Sol: Most organic solvents	

C11-A154

Sulfur Dioxide

CAS: 7446-09-5
RTECS: WS4550000
UN: 1079; 125
EC: 231-195-2
UNII: 0UZA3422Q4
ICD-11: XM0Z74; XM9DN4 (Fumes)

SO_2

Colorless gas with a suffocating, irritating and pungent odor detectable at ≥3 ppm. Shipped as a liquefied compressed gas. This material is hazardous through inhalation and produces local skin/eye impacts. Causes eye irritation with tearing (lacrimation); as well as respiratory irritation with excessive nasal discharge (rhinorrhea) and difficulty breathing (dyspnea). Symptoms may be delayed.

Used industrially for the bleaching of flour, fruit, grain, oil straw, wood pulp, wool; in the tanning of leather; in manufacture of glass; as a reducing agent in minerals processing; as an oxidizing agent in lithium primary batteries; as a preservative for fruit and wine; as a disinfectant in breweries and food factories; as a refrigerant gas; as warning agent for liquid fumigants; and as a chemical intermediate in the production of sodium hydrosulfite; chlorine dioxide, sodium sulfate, sulfuryl chloride, thionyl chloride, and organic sulfonates.

This material is on the DHS Chemicals of Interest list, ITF-25 High Threat list, and NRL High Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 2.62 mg/m^3 at 77°F
$LC_{(Inh)}$: 1,000 ppm; exposure duration 10 minutes
Eye Irritation: 8 ppm; exposure duration unspecified
Severe Eye Irritation: 50 ppm; exposure duration unspecified
Respiratory Irritation: 10 ppm; exposure duration unspecified
$MEG_{(1hr)}$: Neg: 0.20 ppm; Mar: 0.76 ppm; Crit: 30 ppm; Cat: —
PAC-1: 0.20 ppm; *PAC-2:* 0.76 ppm; *PAC-3:* 30 ppm
PEL: 5 ppm
REL: 2 ppm
$STEL_{(ACGIH)}$: 0.25 ppm
$STEL_{(NIOSH)}$: 5 ppm
IDLH: 100 ppm

Final AEGLs
AEGL-1: 1 hr – 0.20 ppm; 4 hr – 0.20 ppm; 8 hr – 0.20 ppm
AEGL-2: 1 hr – 0.75 ppm; 4 hr – 0.75 ppm; 8 hr – 0.75 ppm
AEGL-3: 1 hr – 30 ppm; 4 hr – 19 ppm; 8 hr – 9.6 ppm

Properties:

MW: 64.1	*VP:* 2,475 mmHg	*FlP:* NA
D: 1.4 g/mL (liq. gas, 77°F)	*VD:* 2.3	*LEL:* NA
MP: –104°F	*Vlt:* NA	*UEL*: NA
BP: 14°F	*ER:* 520	*RP:* NA
Vsc: 0.19 cS (liq. gas, 77°F)	*H_2O:* 8.5% (77°F)	*IP:* 12.30 eV
	Sol: Alcohols, ether, chloroform	

C11-A155

Sulfur Tetrafluoride

CAS: 7783-60-0
RTECS: WT4800000
UN: 2418; 125
EC: 232-013-4
UNII: F4P8J39GOF
ICD-11: —

SF_4

Colorless gas with a disagreeable odor similar to sulfur dioxide (C11-A154) that fumes in moist air. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Contact produces severe irritation with first- and second-degree skin and eye burns. Respiratory irritation with excessive nasal discharge (rhinorrhea), difficulty breathing (dyspnea), weakness (lassitude), and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed.

Used industrially as a fluorinating agent and in the production of water- and oil-repellant materials. This material is on the DHS Chemicals of Interest list and the NRL Critical Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 4.42 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.23 ppm; Mar: —; Crit: 1.7 ppm; Cat: —
PAC-1: 0.0090 ppm; *PAC-2:* 0.10 ppm; *PAC-3:* 0.81 ppm
$Ceiling_{(NIOSH)}$: 0.1 ppm
$Ceiling_{(ACGIH)}$: 0.1 ppm

Properties:

MW: 108.1	*VP:* 7,238 mmHg (70°F)	*FlP:* NA
D: 2.0 g/mL (liq. gas, −108°F)	*VD:* 3.7	*LEL:* NA
MP: −186°F	*Vlt:* NA	*UEL*: NA
BP: −36°F	*ER:* 300	*RP:* NA
Vsc: —	*H_2O:* Reacts	*IP:* 12.63 eV
	Sol: Benzene	

C11-A156

Sulfur Trioxide

CAS: 7446-11-9
RTECS: WT4830000
UN: 1829; 137
EC: 231-197-3
UNII: HH2O7V4LYD
ICD-11: —

SO_3

Colorless to pale-yellow, fuming, hygroscopic liquid. Solid is colorless to white crystalline material. Strong oxidizer, may spontaneously ignite combustibles. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts. Contact produces severe irritation with first- and second-degree skin and eye burns; respiratory irritation with difficulty breathing (dyspnea).

Solid material exists in three different structural forms – α, β, and γ – based on the trace amount of water present. Each structure has a different melting point and vapor pressure [α: MP = 144°F; VP = 73 mmHg (77°F); β: MP = 91°F; VP = 344 mmHg (77°F); γ: MP = 62°F; VP = 433 mmHg (77°F)]. Melted sulfur trioxide has a vapor pressure consistent with the γ-form. If contained, solid material in the α-form will undergo a sudden, significant increase in vapor pressure that may result in an explosion.

Used industrially as an oxidizing agent; to manufacture sulfuric acid, sulfonated oils, detergents, and explosives; used in solar energy collectors.

This material is on the DHS Chemicals of Interest list, ITF-25 Medium Threat list and NRL Critical Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 3.27 mg/m^3 at 77°F
Eye Irritation: 1 ppm; exposure duration unspecified
Respiratory Irritation: 10 ppm; exposure duration unspecified
$MEG_{(1hr)}$: Neg: 0.061 ppm; Mar: 2.7 ppm; Crit: 49 ppm; Cat: —
PAC-1: 0.061 ppm; *PAC-2:* 2.7 ppm; *PAC-3:* 49 ppm

Interim AEGLs
AEGL-1: 1 hr – 0.061 ppm; 4 hr – 0.061 ppm; 8 hr – 0.061 ppm
AEGL-2: 1 hr – 2.7 ppm; 4 hr – 2.7 ppm; 8 hr – 2.7 ppm
AEGL-3: 1 hr – 49 ppm; 4 hr – 34 ppm; 8 hr – 28 ppm

Properties:

MW: 80.1	*VP:* 433 mmHg (liq., 77°F)	*FlP:* NA
D: 1.9 g/mL (liq., 77°F)	*VD:* 2.8	*LEL:* NA
MP: (see above)	*Vlt:* 570,000 ppm (liq., 77°F)	*UEL*: NA
BP: 113°F	*ER:* 580	*RP:* 0.03
Vsc: 0.83 cS (liq., 77°F)	*H_2O:* Reacts	*IP:* 12.80 eV
	Sol: —	

C11-A157

Fuming Sulfuric Acid

CAS: 8014-95-7
RTECS: WS5605000
UN: 1831; 137
EC: 616-954-1
UNII: —
ICD-11: XM8724 (Sulfuric acid)

H_2SO_4 + SO_3

Fuming colorless to dark-brown, oily, hygroscopic liquid with a choking, irritating odor. Created by dissolving Sulfur trioxide (C11-A156) (ranging from 10% to 80%) in concentrated sulfuric acid. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts. Contact produces severe irritation with first- and second-degree skin and eye burns; respiratory irritation with difficulty breathing (dyspnea) and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed.

Used industrially as a chemical intermediate for sulfonate surfactants, dyes, explosives, and nitrocellulose; for petroleum refining, and as a drying agent in production of chlorine and nitric acid.

This material is the DHS Chemicals of Interest list, Australia Chemicals of Security Concern list, ITF-25 High Threat list, and NRL High Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 7.28 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.20 mg/m^3; Mar: 63 mg/m^3; Crit: 160 mg/m^3; Cat: —
PAC-1: 0.20 mg/m^3; *PAC-2:* 8.7 mg/m^3; *PAC-3:* 160 mg/m^3

The following exposure limits have been developed for sulfuric acid:

PEL: 1 mg/m^3
REL: 1 mg/m^3
IDLH: 15 mg/m^3

Interim AEGLs for fuming sulfuric acid

AEGL-1: 1 hr – 0.20 mg/m^3; 4 hr – 0.20 mg/m^3; 8 hr – 0.20 mg/m^3
AEGL-2: 1 hr – 8.7 mg/m^3; 4 hr – 8.7 mg/m^3; 8 hr – 8.7 mg/m^3
AEGL-3: 1 hr – 160 mg/m^3; 4 hr – 110 mg/m^3; 8 hr – 93 mg/m^3

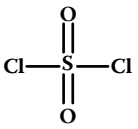
Properties: (varies by SO_3)

MW: Mixture	*VP:* 2.3–164 mmHg	*FlP:* NA
D: >1.8 g/mL	*VD:* 2.8–3.4	*LEL:* NA
MP: 36°–70°F	*Vlt:* —	*UEL*: NA
BP: 140°–280°F	*ER:* —	*RP:* 9,000
Vsc: ≥20 cS	*H_2O:* Miscible	*IP:* —
	Sol: —	

C11-A158

Sulfuryl Chloride

CAS: 7791-25-5
RTECS: WT4870000
UN: 1834; 137
EC: 232-245-6
UNII: JD26K0R3J1
ICD-11: —



$Cl_2\ O_2\ S$

Clear, colorless to light yellow-green mobile liquid with a very pungent odor. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts. Violent irritant; contact produces first- and second-degree burns, severe eye, and respiratory irritation with difficulty breathing (dyspnea) and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed.

Used industrially to treat wool to prevent shrinking; in the manufacture of rayon, rubber-base plastics, chlorophenol disinfectants, phosphate insecticides, heterocyclic fungicides and herbicides, and pharmaceuticals.

This material is on the DHS Chemicals of Interest list and ITF-25 Medium Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 5.52 mg/m^3 at 77°F
MEC$_{(1hr)}$: Neg: 0.31 ppm; Mar: 3.6 ppm; Crit: 11 ppm; Cat: —
PAC-1: 0.31 ppm; *PAC-2:* 3.6 ppm; *PAC-3:* 11 ppm

Final AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 3.7 ppm; 4 hr – 2.3 ppm; 8 hr – 1.2 ppm
AEGL-3: 1 hr – 11 ppm; 4 hr – 7.0 ppm; 8 hr – 3.5 ppm

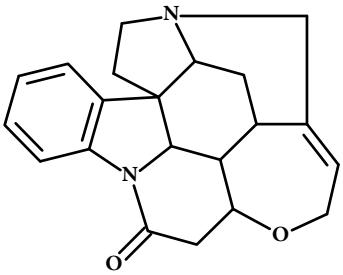
Properties:

MW: 135.0	*VP:* 140 mmHg (77°F)	*FlP:* NA
D: 1.7 g/mL	*VD:* 4.7	*LEL:* NA
MP: –65°F	*Vlt:* 140,000 ppm	*UEL*: NA
BP: 156°F	*ER:* 300	*RP:* 0.08
Vsc: 0.35 cS (100°F)	*H_2O:* Reacts	*IP:* 12.41 eV
	Sol: Toluene, ether	

C11-A159

Strychnine

CAS: 57-24-9; 1421-86-9 (Hydrochloride salt)
RTECS: WL2275000
UN: 1692; 151
EC: 200-319-7; 215-826-9 (Hydrochloride salt)
UNII: H9Y79VD43J; 9651U398A9 (Hydrochloride salt)
ICD-11: XM5421



C_{21} H_{22} N_2 O_2

Colorless or white crystalline material that is odorless. Various salts have been reported. This material is hazardous through inhalation, penetration through broken skin, and ingestion. Effects the central nervous system causing severe muscle contractions, convulsions with a backward bridging position (opisthotonos), and respiratory failure.

Used industrially in poison baits to control rodents, wild pigs and predators.

This material is on the FBI list and Australia Chemicals of Security Concern list.

Exposure Hazards

Conversion Factor: 1 ppm = 13.68 mg/m^3 at 77°F
MEG$_{(1hr)}$: Neg: —; Mar: 0.30 mg/m^3; Crit: 3.0 mg/m^3; Cat: —
PAC-1: 0.45 mg/m^3; *PAC-2:* 0.50 mg/m^3; *PAC-3:* 3.0 mg/m^3
PEL: 0.15 mg/m^3
REL: 0.15 mg/m^3
TLV: 0.15 mg/m^3
IDLH: 3 mg/m^3

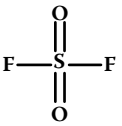
Properties:

MW: 334.4	*VP:* 3 × 10^{-9} mmHg (77°F, est.) (est.)	*FlP:* —
D: 1.4 g/cm^3	*VD:* 11	*LEL:* —
MP: 543°F	*Vlt:* —	*UEL*: —
BP: Decomposes	*ER:* NA	*RP:* —
Vsc: —	*H_2O:* 0.016%	*IP:* —
	Sol: Benzene, chloroform	

C11-A160

Sulfuryl Fluoride

CAS: 2699-79-8
RTECS: WT5075000
UN: 2191; 123
EC: 220-281-5
UNII: 64B59K7U6Q
ICD-11: XM48A5



S F_2 O_2

Colorless gas that is odorless. This material is hazardous through inhalation and produces local skin/eye impacts. Causes severe respiratory irritation with difficulty breathing (dyspnea) and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed. Produces central nervous system depression with convulsions, respiratory failure, and unconsciousness.

Used industrially as a fumigant and in organic synthesis.

This material is on the DHS Chemicals of Interest list, FBI list, and on the ITF-25 Medium Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 4.18 mg/m^3 at 77°F
MEG$_{(1hr)}$: Neg: 9.6 ppm; Mar: 21 ppm; Crit: 65 ppm; Cat: —
PAC-1: 10 ppm; *PAC-2:* 21 ppm; *PAC-3:* 65 ppm
PEL: 5 ppm
REL: 5 ppm
TLV: 5 ppm
STEL$_{(ACGIH)}$: 10 ppm

$STEL_{(NIOSH)}$: 10 ppm
IDLH: 200 ppm

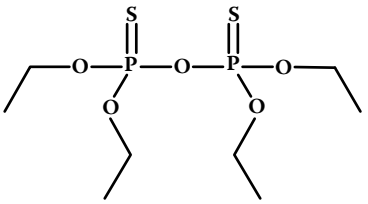
Interim AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 21 ppm; 4 hr – 13 ppm; 8 hr – 6.7 ppm
AEGL-3: 1 hr – 64 ppm; 4 hr – 40 ppm; 8 hr – 20 ppm

Properties:

MW: 102.1	*VP:* 12,750 mmHg (70°F)	*FlP:* NA
D: 1.4 g/mL (liq. gas, 77°F)	*VD:* 3.5	*LEL:* NA
MP: –213°F	*Vlt:* NA	*UEL*: NA
BP: –68°F	*ER:* 330	*RP:* NA
Vsc: 0.11 cS (liq. gas, 77°F)	*H_2O:* 0.2% (32°F)	*IP:* 13.04 eV
	Sol: Sparingly soluble in most organic solvents	

C11-A161

Sulfotepp
CAS: 3689-24-5
RTECS: XN4375000
UN: 1704; 153
EC: 222-995-2
UNII: V41BK2EE8X
ICD-11: XM1E56



$C_8\ H_{20}\ O_5\ P_2\ S_2$

Colorless to pale-yellow liquid with a garlic-like odor. This material is hazardous through inhalation, skin absorption, and ingestion, and produces local skin/eye impacts. It is a cholinesterase inhibitor.

Used industrially as an insecticide and acaricide.

This material is on the FBI list.

Exposure Hazards
Conversion Factor: 1 ppm = 13.18 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.50 mg/m^3; Mar: 3.5 mg/m^3; Crit: 10 mg/m^3; Cat: —
PAC-1: 0.32 mg/m^3; *PAC-2:* 3.6 mg/m^3; *PAC-3:* 35 mg/m^3
PEL: 0.2 mg/m^3 [Skin]
REL: 0.2 mg/m^3 [Skin]
TLV: 0.1 mg/m^3 [Skin]
IDLH: 10 mg/m^3 [Skin]

Properties:

MW: 322.3	*VP:* 1.05×10^{-4} mmHg	*FlP:* NA
D: 1.2 g/mL (77°F)	*VD:* 11	*LEL:* NA
MP: —	*Vlt:* —	*UEL*: NA
BP: Decomposes	*ER:* —	*RP:* 33,000
Vsc: —	H_2O: 0.0025%	*IP:* —
	Sol: Hexane, propanol, toluene	

C11-A162

Tellurium Hexafluoride

CAS: 7783-80-4
RTECS: WY2800000
UN: 2195; 125
EC: 232-027-0
UNII: JWI7143IXR
ICD-11: —

TeF_6

Colorless gas with a repulsive odor. This material is hazardous through inhalation and produces local skin/eye impacts. Causes skin, eye, and respiratory irritation with difficulty breathing (dyspnea) and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed.

It is a byproduct of ore refining.

This material is on the DHS Chemicals of Interest list and ITF-25 Medium Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 9.88 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: —; Mar: 0.018 ppm; Crit: 0.053 ppm; Cat: —
PAC-1: 0.00048 ppm; *PAC-2:* 0.0052 ppm; *PAC-3:* 0.016 ppm
PEL: 0.02 ppm
REL: 0.02 ppm
TLV: 0.02 ppm (as tellurium)
IDLH: 1 ppm

Final AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 0.0053 ppm; 4 hr – 0.0033 ppm; 8 hr – 0.0017 ppm
AEGL-3: 1 hr – 0.016 ppm; 4 hr – 0.010 ppm; 8 hr – 0.0050 ppm

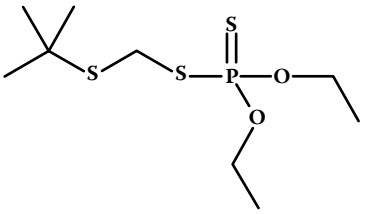
Properties:

MW: 241.6	*VP:* —	*FlP:* NA
D: 4.0 g/cm^3 (–312°F)	*VD:* 8.3	*LEL:* NA
MP: Sublimes (–38°F)	*Vlt:* —	*UEL*: NA
BP: —	*ER:* 240	*RP:* —
Vsc: —	H_2O: Reacts	*IP:* —
	Sol: —	

C11-A163

Terbufos

CAS: 13071-79-9
RTECS: —
UN: —
EC: 235-963-8
UNII: M83BN0F8R9
ICD-11: XM2QB5



$C_9\ H_{21}\ O_2\ P\ S_3$

Clear, colorless to pale-yellow liquid with a mercaptan-like odor. Commercial material may be reddish to brown. This material is hazardous through inhalation, skin absorption, and ingestion, and produces local skin/eye impacts. It is a cholinesterase inhibitor.

Used industrially as a soil insecticide.

This material is on the FBI list and Australia Chemicals of Security Concern list.

Exposure Hazards

Conversion Factor: 1 ppm = 11.80 mg/m^3 at 77°F
MEG$_{(1hr)}$: Neg: 0.030 mg/m^3; Mar: —; Crit: 1.0 mg/m^3; Cat: —
PAC-1: 0.091 mg/m^3; *PAC-2:* 1.0 mg/m^3; *PAC-3:* 2.2 mg/m^3
TLV: 0.01 mg/m^3 [Skin]

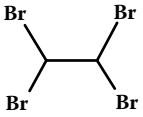
Properties:

MW: 288.4	*VP:* 3.2×10^{-4} mmHg (77°F)	*FlP:* 190°F
D: 1.1 g/mL (75°F)	*VD:* 9.9	*LEL:* —
MP: –20°F	*Vlt:* —	*UEL*: —
BP: 156°F (0.01 mmHg)	*ER:* —	*RP:* 18,000
Vsc: —	*H_2O:* 5×10^{-4}%	*IP:* —
	Sol: Most organic solvents	

C11-A164

1,1,2,2-Tetrabromoethane

CAS: 79-27-6
RTECS: KI8225000
UN: 2504; 159
EC: 201-191-5
UNII: V00GKC584O
ICD-11: —



$C_2 H_2 Br_4$

Colorless to yellow liquid with a pungent camphor- or iodoform-like odor. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts. Causes skin and eye irritation, and produces central nervous system depression.

Used industrially as a solvent, ore flotation agent, level indicator in sight gauges and as a polymerization catalyst.

This material is on the NRL Critical Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 14.14 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 5.3 ppm; Mar: —; Crit: 7.1 ppm; Cat: —
PAC-1: 0.30 ppm; *PAC-2:* 4.3 ppm; *PAC-3:* 9.9 ppm
PEL: 1 ppm
TLV: 0.1 ppm
IDLH: 8 ppm

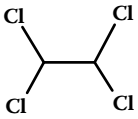
Properties:

MW: 345.7	*VP:* 0.1 mmHg	*FlP:* 206°F
D: 3.0 g/mL	*VD:* 12	*LEL:* —
MP: 32°F	*Vlt:* 2.6 ppm	*UEL*: —
BP: 470°F	*ER:* —	*RP:* 2,700
Vsc: —	*H_2O:* 0.07% (86°F)	*IP:* —
	Sol: Miscible in ethanol, ether, chloroform	

C11-A165

1,1,2,2-Tetrachloroethane

CAS: 79-34-5
RTECS: KI8575000
UN: 1702; 151
EC: 201-197-8
UNII: 1L6BI049XV
ICD-11: XM4N54



$C_2 H_2 Cl_4$

Colorless to pale-yellow mobile liquid with a sweetish, chloroform-like odor that is detectable at ≥1.5 ppm. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Causes skin and severe eye irritation with tearing (lacrimation), and produces central nervous system depression with convulsions and unconsciousness.

Used industrially as a solvent, degreasing agent, and paint remover.

This material is on the NRL Critical Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 6.87 mg/m^3 at 77°F
MEG$_{(1hr)}$: Neg: 2.9 ppm; Mar: 29 ppm; Crit: 87 ppm; Cat: —
PAC-1: 3.1 ppm; *PAC-2:* 120 ppm; *PAC-3:* 150 ppm
PEL: 5 ppm [Skin]
REL: 1 ppm [Skin]
TLV: 1ppm [Skin]
IDLH: 100 ppm [Skin]

Properties:

MW: 167.9	*VP:* 4.85 mmHg	*FlP:* NA
D: 1.6 g/mL	*VD:* 5.8	*LEL:* NA
MP: −44°F	*Vlt:* 7,600 ppm	*UEL*: NA
BP: 295°F	*ER:* 230	*RP:* 1.4
Vsc: 1.11 cS	*H$_2$O:* 0.3%	*IP:* 11.10 eV
	Sol: Miscible in ether and alcohols	

C11-A166

Tetrachlorosilane

CAS: 10026-04-7
RTECS: VW0525000
UN: 1818; 157
EC: 233-054-0
UNII: 96L75U0BM3
ICD-11: —

$SiCl_4$

Colorless to slightly pale-yellow, fuming, mobile liquid with a pungent, suffocating odor detectable at ≥5 ppm. This material is hazardous through inhalation, and ingestion, and produces local skin/eye impacts. Contact produces first- and second-degree burns, severe eye irritation. Severe respiratory irritant with difficulty breathing (dyspnea) and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed.

Used industrially as to make high-purity silica for semiconductors, solar cells, optical fibers, and in the manufacture of adhesives and sealants.

This material is the DHS Chemicals of Interest list.

This material has been used by the military in various smoke formulations.

Exposure Hazards

Conversion Factor: 1 ppm = 6.95 mg/m^3 at 77°F
MEG$_{(1hr)}$: Neg: 0.45 ppm; Mar: 5.5 ppm; Crit: 24 ppm; Cat: —
PAC-1: 0.45 ppm; *PAC-2:* 5.5 ppm; *PAC-3:* 24 ppm
Ceiling$_{(OARS)}$: 1ppm

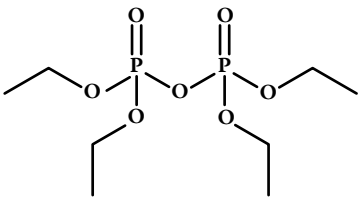
Final AEGLs
AEGL-1: 1 hr – 0.45 ppm; 4 hr – 0.45 ppm; 8 hr – 0.45 ppm
AEGL-2: 1 hr – 5.5 ppm; 4 hr – 2.8 ppm; 8 hr – 2.8 ppm
AEGL-3: 1 hr – 25 ppm; 4 hr – 6.5 ppm; 8 hr – 6.5 ppm

Properties:

MW: 169.9	*VP:* 195 mmHg	*FlP:* NA
D: 1.5 g/mL	*VD:* 5.9	*LEL:* NA
MP: –94°F	*Vlt:* 260,000 ppm	*UEL*: NA
BP: 136°F	*ER:* 210	*RP:* 0.04
Vsc: 0.35 cS	*H_2O:* Reacts	*IP:* 11.79 eV
	Sol: Ether, chloroform, benzene	

C11-A167

Tetraethyl Pyrophosphate (Agent EA 1285)
CAS: 107-49-3
RTECS: UX6825000
UN: —
EC: 203-495-3
UNII: 28QKT80KX2
ICD-11: XM6P90



$C_8\ H_{20}\ O_7\ P_2$

Colorless to amber, hygroscopic liquid with a faint, fruity odor. This material is hazardous through inhalation, skin absorption, and ingestion, and produces local skin/eye impacts. It is a cholinesterase inhibitor.

Used industrially as an insecticide and acaricide.

This material is on the FBI list and on the ITF-25 Low Threat list.

Exposure Hazards
Conversion Factor: 1 ppm = 11.87 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.15 mg/m^3; Mar: 1.0 mg/m^3; Crit: 5.0 mg/m^3; Cat: —
PAC-1: 0.091 mg/m^3; *PAC-2:* 1.0 mg/m^3; *PAC-3:* 10 mg/m^3
PEL: 0.05 mg/m^3 [Skin]
REL: 0.05 mg/m^3 [Skin]
TLV: 0.01 mg/m^3 [Skin]
IDLH: 5 mg/m^3 [Skin]

Properties:

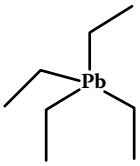
MW: 290.2	*VP:* 4.7×10^{-4} mmHg (86°F)	*FlP:* —
D: 1.2 g/mL	*VD:* 10	*LEL:* —
MP: 32°F	*Vlt:* —	*UEL*: —

BP: 280°F (2.3 mmHg)	*ER:* —	*RP:* 29,000
Vsc: —	*H_2O:* Miscible (decomposes)	*IP:* —
	Sol: Acetone, alcohols, chloroform	

C11-A168

Tetraethyl Lead

CAS: 78-00-2
RTECS: TP4550000
UN: —
EC: 201-075-4
UNII: 13426ZWT6A
ICD-11: XM17Q5



C_8 H_{20} Pb

Colorless, oily liquid with a pleasant, musty or sweet odor. Commercial material may be dyed red, orange, or blue. This material is hazardous through inhalation, skin absorption (liquid), penetration through broken skin, and ingestion, and produces local skin/eye impacts. Causes skin and eye irritation, and produces central nervous system depression including headache, dizziness, and weakness (lassitude), convulsions, and unconsciousness.

Used industrially to manufacture metal alkyls, fungicides; formerly used as a gasoline additive.

This material is on the ITF-25 Low Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 13.23 mg/m^3 at 77°F
Intoxication: 7.6 ppm for a 60-minute exposure
$MEG_{(1hr)}$: Neg: 0.036 ppm; Mar: 0.30 ppm; Crit: 4.7 ppm; Cat: —
PAC-1: 0.023 ppm; *PAC-2:* 0.30 ppm; *PAC-3:* 3.0 ppm
PEL: 0.0057 ppm [Skin] (as lead)
REL: 0.0057 ppm [Skin] (as lead)
TLV: 0.0076 ppm [Skin] (as lead)
IDLH: 3.0 ppm [Skin] (as lead)

Properties:

MW: 323.5	*VP:* 0.2 mmHg	*FlP:* 200°F
D: 1.7 g/mL	*VD:* 8.6	*LEL:* 1.8%
MP: –202°F	*Vlt:* 340 ppm (77°F)	*UEL*: —
BP: 228°F (decomposes)	*ER:* —	*RP:* 22
Vsc: 0.52 cS	*H_2O:* 2 × 10^{-5}%	*IP:* 11.10 eV
	Sol: Benzene' ether, ethanol	

C11-A169

Tetrafluoroboric Acid

CAS: 16872-11-0
RTECS: ED2685000
UN: 1775; 154
EC: 240-898-3
UNII: H429WZ9FBQ
ICD-11: —

HBF_4

Does not exist as a free, pure substance; it is only stable as a solution. Commercially sold a colorless to light-yellow aqueous solution with 20%–70% acid that is odorless. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts. Causes skin and eye irritation with blisters (vesiculation) and respiratory irritation with difficulty breathing (dyspnea) and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed.

Used industrially as a catalyst, metal cleaner, and in electrolyte plating.

This material is on the NRL Critical Threat list.

Exposure Hazards

$MEG_{(1hr)}$: Neg: 7.5 mg/m^3; Mar: 60 mg/m^3; Crit: 290 mg/m^3; Cat: —
PAC-1: 8.7 mg/m^3; *PAC-2:* 97 mg/m^3; *PAC-3:* 580 mg/m^3

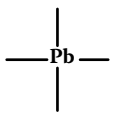
Properties:

MW: 87.8	*VP:* —	*FlP:* NA
D: 1.4 g/mL–1.8 g/mL	*VD:* —	*LEL:* NA
MP: —	*Vlt:* —	*UEL*: NA
BP: 266°F (decomposes)	*ER:* —	*RP:* —
Vsc: —	*H_2O:* Miscible	*IP:* —
	Sol: Ethanol	

C11-A170

Tetramethyl Lead

CAS: 75-74-1
RTECS: TP4725000
UN: —
EC: 200-897-0
UNII: C7J62Z32IW
ICD-11: XM17Q5



$C_4\ H_{12}\ Pb$

Colorless oily liquid with a musty or fruity odor. Commercial material may be dyed red, orange, or blue. This material is hazardous through inhalation, skin absorption (liquid), penetration through broken skin, and ingestion. Produces central nervous system depression including headache, dizziness, convulsions, and unconsciousness.

Used industrially as an anti-knock additive for gasoline

This material is on the DHS Chemicals of Interest list and ITF-25 Low Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 10.93 mg/m^3 at 77°F

Based on available information, this material appears to be approximately one third as toxic as Tetraethyl lead (C11-A168).

$MEG_{(1hr)}$: Neg: 0.053 ppm; Mar: 0.37 ppm; Crit: 4.8 ppm; Cat: —
PAC-1: 0.041 ppm; *PAC-2:* 0.37 ppm; *PAC-3:* 3.7 ppm
PEL: 0.007 ppm [Skin] (as lead)
REL: 0.007 ppm [Skin] (as lead)
TLV: 0.014 ppm [Skin] (as lead)
IDLH: 3.7 ppm [Skin] (as lead)

Properties:

MW: 267.3	*VP:* 23 mmHg	*FlP:* 100°F
D: 2.0 g/mL	*VD:* 6.5	*LEL:* 1.8%
MP: –18°F	*Vlt:* 35,000 ppm	*UEL:* —
BP: 230°F (decomposes)	*ER:* —	*RP:* 0.23
Vsc: 0.29 cS	*H_2O:* 0.0015% (77°F)	*IP:* 8.50 eV
	Sol: Alcohols, benzene	

C11-A171

Thallium Sulfate

CAS: 7446-18-6
RTECS: XG6800000
UN: —
EC: 231-201-3
UNII: U9F9QIR12T
ICD-11: XM9YD2

Tl_2SO_4

Colorless to white crystalline solid that is odorless. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Causes skin, eye and respiratory irritation; produces central nervous system depression including headache, dizziness, and weakness (lassitude), convulsions and unconsciousness.

Used industrially in poison baits to control rodents and ants, and as an analytical chemistry reagent.

This material is on the FBI list, Australia Chemicals of Security Concern list, and NRL High Threat list.

Exposure Hazards

$MEG_{(1hr)}$: Neg: 0.37 mg/m^3; Mar: 2.0 mg/m^3; Crit: 19 mg/m^3; Cat: —
PAC-1: 0.18 mg/m^3; *PAC-2:* 2.0 mg/m^3; *PAC-3:* 25 mg/m^3

Properties:

MW: 504.8	*VP:* —	*FlP:* NA
D: 6.8 g/cm^3	*VD:* —	*LEL:* NA
MP: 1,170°F	*Vlt:* —	*UEL:* NA

BP: —	*ER:* NA	*RP:* NA
Vsc: —	*H_2O:* 4.9% (59°F)	*IP:* 9.80 eV
	Sol: —	

C11-A172

Titanium Tetrachloride (Agent FM)
CAS: 7550-45-0
RTECS: XR1925000
UN: 1838; 137
EC: 231-441-9
UNII: 8O3PJE5T7Q
ICD-11: XM4WJ2

$TiCl_4$
Colorless to light-yellow liquid that fumes in moist air, with a penetrating acid odor. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts. Contact produces first- and second-degree burns, severe eye irritation. Severe respiratory irritant with possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed.

Used industrially to produce pure titanium and titanium salts; pigments; as an additive in decorative glass; and as a polymerization catalyst.

This material is on the DHS Chemicals of Interest list and ITF-25 Medium Threat list.

This material has been used by the U.S. military as a smoke producing agent.

Exposure Hazards
Conversion Factor: 1 ppm = 7.76 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.64 ppm; Mar: 1.0 ppm; Crit: 5.7 ppm; Cat: —
PAC-1: 0.64 ppm; *PAC-2:* 1.0 ppm; *PAC-3:* 5.7 ppm
WEEL: 0.06 ppm

Interim AEGLs
AEGL-1: Not Developed
AEGL-2: 1 hr – 1.0 ppm; 4 hr – 0.21 ppm; 8 hr – 0.094 ppm
AEGL-3: 1 hr – 5.7 ppm; 4 hr – 2.0 ppm; 8 hr – 0.91 ppm

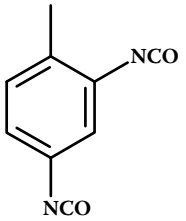
Properties:

MW: 189.7	*VP:* 9.96 mmHg	*FlP:* NA
D: 1.8 g/mL	*VD:* 6.5	*LEL:* NA
MP: –11°F	*Vlt:* 13,000 ppm	*UEL*: NA
BP: 277°F	*ER:* —	*RP:* 0.72
Vsc: 0.046 cS	*H_2O:* Reacts	*IP:* 11.50 eV
	Sol: Most organic solvents	

C11-A173

Toluene 2,4-Diisocyanate
CAS: 584-84-9
RTECS: CZ6300000
UN: 2078; 156

EC: 209-544-5
UNII: 17X7AFZ1GH
ICD-11: XM36N4



$C_9\ H_6\ N_2\ O_2$

Colorless solid or liquid with a sharp, pungent, fruity odor that is detectable at ≥2.1 ppm. It turns pale yellow on exposure to air. Commercial material typically consists of a mixture of 80% of the 2,4-isomer and 20% of the 2,6-isomer (C11-A174). This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Contact produces severe skin irritation with blistering (vesiculation) and eye irritation with tearing (lacrimation). Severe respiratory irritant with difficulty breathing (dyspnea), with possible inflammation of lung tissue (pneumonitis) and accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed. It causes sensitization through both inhalation and skin contact.

Used industrially to manufacture polyurethane foams, elastomers, and coatings; used as a cross-linking agent.

This material is on the DHS Chemicals of Interest list, ITF-25 Low Threat list, and NRL Critical Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 7.12 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.020 ppm; Mar: 0.083 ppm; Crit: 0.51 ppm; Cat: —
PAC-1: 0.020 ppm; *PAC-2:* 0.083 ppm; *PAC-3:* 0.51 ppm
TLV: 0.001 ppm
$Ceiling_{(OSHA)}$: 0.02 ppm
$STEL_{(ACGIH)}$: 0.005 ppm
IDLH: 2.5 ppm
Final AEGLs
AEGL-1: 1 hr – 0.020 ppm; 4 hr – 0.010 ppm; 8 hr – 0.010 ppm
AEGL-2: 1 hr – 0.083 ppm; 4 hr – 0.021 ppm; 8 hr – 0.021 ppm
AEGL-3: 1 hr – 0.51 ppm; 4 hr – 0.32 ppm; 8 hr – 0.16 ppm

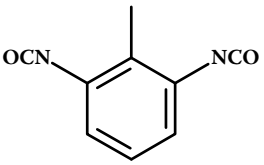
Properties:

MW: 174.2	*VP:* 0.008 mmHg	*FlP:* 260°F
D: 1.2 g/mL (77°F)	*VD:* 6.0	*LEL:* 0.9%
MP: 70°F	*Vlt:* 11 ppm	*UEL*: 9.5%
BP: 484°F	*ER:* —	*RP:* 940
Vsc: 3.8 cS (77°F)	*H_2O:* Insoluble (decomposes slowly)	*IP:* 8.82 eV
	Sol: Ether, acetone, benzene	

C11-A174

Toluene 2,6-Diisocyanate

CAS: 91-08-7
RTECS: CZ6310000
UN: 2078; 156
EC: 202-039-0
UNII: 78243HXH5O
ICD-11: —



$C_9\ H_6\ N_2\ O_2$

Cloudy, colorless to pale-yellow liquid with a pungent odor. Commercial material typically consists of a mixture of 80% of the 2,4-isomer (C11-A173) and 20% of the 2,6-isomer. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Contact produces severe skin irritation with blistering (vesiculation) and eye irritation with tearing (lacrimation). Severe respiratory irritant with difficulty breathing (dyspnea), with possible inflammation of lung tissue (pneumonitis) and accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed. It causes sensitization through both inhalation and skin contact.

Used industrially to manufacture polyurethane foams, elastomers, and coatings; used as a cross-linking agent.

This material is on the DHS Chemicals of Interest list and ITF-25 Low Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 7.12 mg/m^3 at 77°F
Eye Irritation: the 2,6-isomer is less severe than the 2,4-isomer
$MEG_{(1hr)}$: Neg: 0.020 ppm; Mar: 0.083 ppm; Crit: 0.50 ppm; Cat: —
PAC-1: 0.020 ppm; *PAC-2:* 0.083 ppm; *PAC-3:* 0.50 ppm
TLV: 0.001 ppm
$STEL_{(ACGIH)}$: 0.005 ppm
Final AEGLs
AEGL-1: 1 hr – 0.020 ppm; 4 hr – 0.010 ppm; 8 hr – 0.010 ppm
AEGL-2: 1 hr – 0.083 ppm; 4 hr – 0.021 ppm; 8 hr – 0.021 ppm
AEGL-3: 1 hr – 0.51 ppm; 4 hr – 0.32 ppm; 8 hr – 0.16 ppm

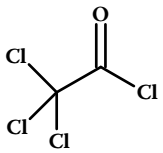
Properties:

MW: 174.2	*VP:* 0.0209 mmHg	*FlP:* 260°F
D: 1.2 g/mL	*VD:* 6.0	*LEL:* 0.9%
MP: 65°F	*Vlt:* 28 ppm	*UEL*: 9.5%
BP: 264°F (18 mmHg)	*ER:* —	*RP:* 360
Vsc: 2.4 cS (77°F)	*H_2O:* Insoluble (decomposes slowly)	*IP:* —
	Sol: Acetone, benzene	

C11-A175

Trichloroacetyl Chloride

CAS: 76-02-8
RTECS: AO7140000
UN: 2442; 156
EC: 200-926-7
UNII: 9SN86T76Y6
ICD-11: —



C_2 Cl_4 O

Clear, colorless to very pale-yellow liquid with a strong odor that fumes in moist air. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts. Causes severe skin, eye, and respiratory irritation with first- and second-degree burns and difficulty breathing (dyspnea).

Used industrially in the manufacture of pharmaceuticals and as a chemical intermediate.

This material is on the ITF-25 Medium Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 7.44 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 0.081 ppm; Mar: 0.54 ppm; Crit: 6.7 ppm; Cat: —
PAC-1: 0.036 ppm; *PAC-2:* 0.40 ppm; *PAC-3:* 2.8 ppm

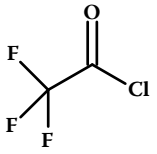
Properties:

MW: 181.8	*VP:* 16 mmHg	*FlP:* 212°F
D: 1.6 g/mL	*VD:* 6.3	*LEL:* —
MP: –25°F	*Vlt:* 23,000 ppm	*UEL*: —
BP: 240°F	*ER:* —	*RP:* 0.43
Vsc: —	*H_2O:* Reacts	*IP:* 11.31 eV
	Sol: Ether, alcohols	

C11-A176

Trifluoroacetyl Chloride

CAS: 354-32-5
RTECS: AO7150000
UN: 3057; 125
EC: 206-556-2
UNII: A23U71SY9G
ICD-11: —



C_2 Cl F_3 O

Colorless gas with an acrid, choking odor that fumes in moist air. This material is hazardous through inhalation and produces local skin/eye impacts. Causes severe skin, eye, and respiratory irritation with first- and second-degree burns and difficulty breathing (dyspnea).

Used industrially in the manufacture of pharmaceuticals and as a chemical intermediate.

This material is on the DHS Chemicals of Interest list and ITF-25 Medium Threat list.

Exposure Hazards

Conversion Factor: 1 ppm = 5.42 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 6.5 ppm; Mar: 46 ppm; Crit: 240 ppm; Cat: —
PAC-1: 3.3 ppm; *PAC-2:* 33 ppm; *PAC-3:* 200 ppm

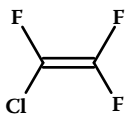
Properties:

MW: 132.5	*VP:* 3,760 mmHg (77°F)	*FlP:* NA
D: 1.4 g/mL (liq. gas, 77°F)	*VD:* 4.6	*LEL:* NA
MP: –231°F	*Vlt:* NA	*UEL*: NA
BP: –17°F	*ER:* 250	*RP:* NA
Vsc: —	*H_2O:* Reacts	*IP:* —
	Sol: —	

C11-A177

Trifluorochloroethylene

CAS: 79-38-9
RTECS: KV0525000
UN: 1082; 119P
EC: 201-201-8
UNII: AF215GW34G
ICD-11: —



C_2 Cl F_3

Colorless gas with a faint ethereal odor. This material is hazardous through inhalation. Effects include central nervous system depression with dizziness and nausea.

Used industrially in the production of lubricants, plastics and resins.

This material is on the DHS Chemicals of Interest list.

Exposure Hazards

Conversion Factor: 1 ppm = 4.76 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 16 ppm; Mar: 86 ppm; Crit: 420 ppm; Cat: —

PAC-1: 16 ppm; *PAC-2:* 86 ppm; *PAC-3:* 420 ppm
WEEL: 5 ppm

Interim AEGLs
AEGL-1: 1 hr – 16 ppm; 4 hr – 10 ppm; 8 hr – 10 ppm
AEGL-2: 1 hr – 86 ppm; 4 hr – 54 ppm; 8 hr – 54 ppm
AEGL-3: 1 hr – 420 ppm; 4 hr – 150 ppm; 8 hr – 91 ppm

Properties:

MW: 116.5	*VP:* 4,600 mmHg (77°F)	*FlP:* –18°F
D: 1.3 g/mL (liq. gas)	*VD:* 4.0	*LEL:* 8.4%
MP: –253°F	*Vlt:* NA	*UEL*: 38.7%
BP: –18°F	*ER:* 230	*RP:* NA
Vsc: —	*H_2O:* 0.4% (Decomposes)	*IP:* 9.81 eV
	Sol: Benzene, chloroform	

C11-A178

Trimethylamine
CAS: 75-50-3; 593-81-7 (Hydrochloride salt)
RTECS: PA0350000
UN: 1083; 118 / 1297; 132 (Aqueous solution)
EC: 200-875-0; 209-810-0 (Hydrochloride salt)
UNII: LHH7G8O305; UW38SRM77K (Hydrochloride salt)
ICD-11: —



C_3 H_9 N

Colorless gas with a pungent, fishy odor detectable at ≥0.0002 ppm. Odor becomes ammonia-like at higher concentration. Various salts (solids) have been reported. This material is hazardous through inhalation and ingestion, and produces local skin/eye impacts. Causes severe eye and respiratory irritation with difficulty breathing (dyspnea) and possible accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed.

Used industrially as a food additive/flavoring agent; for the manufacture of disinfectants; as an insect attractant, flotation agent, and as a warning agent in other gases.

This material is on the NRL Critical Threat list.

Exposure Hazards
Conversion Factor: 1 ppm = 2.42 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 7.9 ppm; Mar: 120 ppm; Crit: 380 ppm; Cat: —
PAC-1: 7.9 ppm; *PAC-2:* 120 ppm; *PAC-3:* 380 ppm
REL: 10 ppm
TLV: 5 ppm
WEEL: 1 ppm
$STEL_{(ACGIH)}$: 15 ppm
$STEL_{(NIOSH)}$: 15 ppm

Interim AEGLs
AEGL-1: 1 hr – 8.0 ppm; 4 hr – 8.0 ppm; 8 hr – 8.0 ppm
AEGL-2: 1 hr – 120 ppm; 4 hr – 67 ppm; 8 hr – 51 ppm
AEGL-3: 1 hr – 380 ppm; 4 hr – 220 ppm; 8 hr – 170 ppm

Properties:

MW: 59.1	*VP:* 1,450 mmHg	*FlP:* 20°F
D: 0.67 g/mL (32°F)	*VD:* 2.0	*LEL:* 2.0%
MP: –179°F	*Vlt:* NA	*UEL*: 11.6%
BP: 37°F	*ER:* 270	*RP:* NA
Vsc: 0.26 cS (liq. gas, 77°F)	H_2O: 41%	*IP:* 7.82 eV
	Sol: Ether, toluene, chloroform	

Hydrochloride Salt
MW: 95.6
D: 1.0 g/cm^3
MP: Sublimes (392°F)
BP: Decomposes (541°F)
H_2O: 74%

C11-A179

Tungsten Hexafluoride
CAS: 7783-82-6
RTECS: YO7720000
UN: 2196; 125
EC: 232-029-1
UNII: 45B0AG2C4S
ICD-11: —

WF_6
Colorless gas or pale-yellow, hygroscopic liquid that is odorless. Decomposes to produce Hydrogen fluoride (C11-A089) in contact with moisture; strong oxidizer, may spontaneously ignite combustibles. This material is hazardous through inhalation, skin absorption, penetration through broken skin, and ingestion, and produces local skin/eye impacts. Contact produces first- and second-degree burns, severe eye irritation with tearing (lacrimation). Severe respiratory irritant with difficulty breathing (dyspnea) with possible inflammation of lung tissue (pneumonitis) and accumulation of fluid in the lungs (pulmonary edema). Symptoms may be delayed. Affects the central nervous system producing spasms, convulsions and unconsciousness.

Used industrially to apply tungsten coatings to other surfaces; as a chemical intermediate and in the manufacture of electronics.

This material is on the DHS Chemicals of Interest list, ITF-25 High Threat list and NRL Critical Threat list.

Exposure Hazards
Conversion Factor: 1 ppm = 12.17 mg/m^3 at 77°F

Based on available information, this material appears to be approximately one sixth as toxic as Hydrogen fluoride (C11-A089).

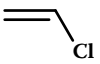
$MEG_{(1hr)}$: Neg: 0.40 ppm; Mar: 0.67 ppm; Crit: 3.3 ppm; Cat: —
PAC-1: 0.40 ppm; *PAC-2:* 4.4 ppm; *PAC-3:* 26 ppm

Properties:

MW: 297.5	*VP:* 863 mmHg (70°F)	*FlP:* NA
D: 4.6 g/cm^3 (solid, 16°F)	*VD:* 10	*LEL:* NA
D: 3.5 g/mL (liq. gas)	*Vlt:* —	*UEL*: NA
MP: 36°F	*ER:*280	*RP:* —
BP: 63°F	*H_2O:* Reacts	*IP:* 15.20 eV
Vsc: 0.13 cS (liq. gas, 77°F)	*Sol:* Carbon tetrachloride, cyclohexane	

C11-A180

Vinyl Chloride
CAS: 75-01-4
RTECS: KU9625000
UN: 1086; 116P
EC: 200-831-0
UNII: WD06X94M2D
ICD-11: XM6YR0



C_2 H_3 Cl

Colorless gas or liquid with a mild, sweet odor at high concentrations (≥3,000 ppm). This material is hazardous through inhalation and produces local skin/eye impacts. Causes eye irritation and produces central nervous system depression including weakness (lassitude), convulsions, and unconsciousness.

Used industrially to produce poly(vinyl chloride) and copolymers, as an inhibitor in the production of ethylene oxide, and as a chemical intermediate for various materials including methyl chloroform, 1,1,1-trichloroethane, and chloroacetaldehyde.

This material is on the DHS Chemicals of Interest list.

Exposure Hazards
Conversion Factor: 1 ppm = 2.56 mg/m^3 at 77°F
$MEG_{(1hr)}$: Neg: 250 ppm; Mar: 1,200 ppm; Crit: 4,700 ppm; Cat: —
PAC-1: 250 ppm; *PAC-2:* 1,200 ppm; *PAC-3:* 4,700 ppm
PEL: 1 ppm
TLV: 1 ppm
$Ceiling_{(OSHA)}$: 5 ppm

Final AEGLs
AEGL-1: 1 hr – 250 ppm; 4 hr – 140 ppm; 8 hr – 70 ppm
AEGL-2: 1 hr – 1,200 ppm; 4 hr – 820 ppm; 8 hr – 820 ppm
AEGL-3: 1 hr – 4,800 ppm; 4 hr – 3,400 ppm; 8 hr – 3,400 ppm

Properties:

MW: 62.5	*VP:* 2,500 mmHg	*FlP:* –108°F
D: 0.91 g/mL (liq. gas, 68°F)	*VD:* 2.2	*LEL:* 3.6%
MP: –245°F	*Vlt:* NA	*UEL*: 33%
BP: 7°F	*ER:* 350	*RP:* NA
Vsc: 0.19 cS (liq. gas, 77°F)	H_2O: 0.1% (77° F)	*IP:* 9.99 eV
	Sol: Ethanol, ether, carbon tetrachloride	

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Alphanumeric Indices

There are six indices in this volume to allow easy access to specific agents in this handbook. These indices are the Alphabetical Index of Chemical Names, Military Codes and Synonyms, the Chemical Abstract Service (CAS) numbers index, the United Nations (UN) numbers index, the European Inventory of Existing Commercial Chemical Substances (EC) numbers index, the U.S. Food and Drug Administration Unique Ingredient Identifiers (UNII) index and the 11th Revision of the International Statistical Classification of Diseases and Related Health Problems (ICD-11) codes.

Each of these indices is in alphanumeric order and entries are cross-referenced to information about the specific agent through the Handbook Number. The first two digits of the handbook number following the "C" indicate the class of agent. The classes appear in order from C01 through C21 as the chapters of this handbook. They provide general information about each subgroup of agents. The letter following the hyphen (e.g., C01-**A**) indicates that the materials is primarily used as an agent (A), component or precursor in the manufacture of that class of agents (C) or is a significant decomposition product or impurity of that class of agents (D). The three digits that follow the letter indicate the specific agent in the order that it appears in this handbook (e.g., C01-A**001**). These numbers proceed sequentially in each chapter. Materials that are not individually detailed in this handbook, typically due to the absence of published chemical or toxicological information, are only cross-referenced to the appropriate class. These materials do not have numbers after the letter following the hyphen (e.g., C01-A).

The list of synonyms included in the alphabetical index is by no means exhaustive. Although it contains a large number of formal chemical and biological names, it primarily contains historical names, military code names, and common names for the agents, precursors, components and degradation products included in this handbook. In some instances, names have been included that have been popularized in the media but have no other historical connection to the agent.

Some synonyms in the alphabetical index are followed by bracketed notations. These notations provide additional clarifying information about the entry such as composition, modifications to the agents (e.g., thickened, dusty, binary), or a note for historical context. For example, "White Star" was a gas blend that was employed by the British in World War I consisting of 50% phosgene and 50% chlorine. The entry appears as:

White Star (British WWI Cylinder Gas) {Phosgene (50%) and Chlorine (50%) Mixture}

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α,β-Dichloroethane	C11-A070
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β-Chloroethyldimethylamine	C01-C099
β-Chloroethyl-N,N-dimethylamine Hydrochloride	C01-C099
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β-Chlorovinylbichloroarsine	C04-A002
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β-Dimethylaminoethyl Chloride Hydrochloride	C01-C099
β-Endosulfan	C11-A063
β-Ethylmercaptoethyl Diethyl Thionophosphate	C11-A050
β-Fluoroethanol	C11-A079
β-Fluoroethyl Fluoroacetate	C11-A080
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β-Thionex	C11-A063
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γ-Chloroisobutylene	C11-A102
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γ-Methylenepropiolactone	C11-A057
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(1-Methylethyl)phosphoramidic Acid Ethyl 3-Methyl-4-(methylthio)phenyl Ester	C11-A074
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(2,2-Dichloro-vinil)dimetil-fosfato	C11-A055
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(2,2-Dichlor-vinyl)-dimethyl-phosphat	C11-A055
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(2-Methoxyethyl)mercurio Acetate	C11-A108
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1-(N,N,N-Tributylammonio)-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio] decane Di(Hydrogen Sulfate)	C02-A047
1-(N,N,N-Tributylammonio)-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio] decane Dibromide	C02-A047
1-(N,N,N-Tributylammonio)-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio] decane Dinitrate	C02-A047
1-(N,N,N-Tributylammonio)-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio] decane Tetraphenylboronate	C02-A047
1-(N,N,N-Trimethylammonio)-10-[N-(2-dimethylcarbamoxybenzyl)-N,N-dimethylammonio]decane Di(Hydrogen Oxalate)	C02-A033
1-(N,N,N-Trimethylammonio)-10-[N-(2-dimethylcarbamoxybenzyl)-N,N-dimethylammonio]decane Di(Hydrogen Sulfate)	C02-A033
1-(N,N,N-Trimethylammonio)-10-[N-(2-dimethylcarbamoxybenzyl)-N,N-dimethylammonio]decane Di(Tetraphenylboronate)	C02-A033
1-(N,N,N-Trimethylammonio)-10-[N-(2-dimethylcarbamoxybenzyl)-N,N-dimethylammonio]decane Dibromide	C02-A033
1-(N,N,N-Trimethylammonio)-10-[N-(2-dimethylcarbamoxybenzyl)-N,N-dimethylammonio]decane Dinitrate	C02-A033

(*Continued*)

1-(N,N,N-Trimethylammonio)-10-[N-(2-dimethylcarbamoxybenzyl)-N,N-dimethylammonio]decane Diperchlorate	C02-A033
1-(N,N,N-Trimethylammonio)-10-[N-(5-dimethylcarbamoxy)isoquinolinio]decane Di(Hydrogen Oxalate)	C02-A029
1-(N,N,N-Trimethylammonio)-10-[N-(5-dimethylcarbamoxy)isoquinolinio]decane Di(Hydrogen Sulfate)	C02-A029
1-(N,N,N-Trimethylammonio)-10-[N-(5-dimethylcarbamoxy)isoquinolinio]decane Di (Tetraphenylboronate)	C02-A029
1-(N,N,N-Trimethylammonio)-10-[N-(5-dimethylcarbamoxy)isoquinolinio]decane Dibromide	C02-A029
1-(N,N,N-Trimethylammonio)-10-[N-(5-dimethylcarbamoxy)isoquinolinio]decane Dinitrate	C02-A029
1-(N,N,N-Trimethylammonio)-10-[N-(5-dimethylcarbamoxy)isoquinolinio]decane Diperchlorate	C02-A029
1-(N,N,N-trimethylammonio)-8-[N-(2-dimethylcarbamoxybenzyl)-N,N-dimethylammonio]octane Di (Hydrogen Oxalate)	C02-A028
1-(N,N,N-trimethylammonio)-8-[N-(2-dimethylcarbamoxybenzyl)-N,N-dimethylammonio]octane Di (Hydrogen Sulfate)	C02-A028
1-(N,N,N-trimethylammonio)-8-[N-(2-dimethylcarbamoxybenzyl)-N,N-dimethylammonio]octane Di (Tetraphenylboronate)	C02-A028
1-(N,N,N-trimethylammonio)-8-[N-(2-dimethylcarbamoxybenzyl)-N,N-dimethylammonio]octane Dibromide	C02-A028
1-(N,N,N-trimethylammonio)-8-[N-(2-dimethylcarbamoxybenzyl)-N,N-dimethylammonio]octane Dinitrate	C02-A028
1-(N,N,N-Trimethylammonio)-8-[N-(2-dimethylcarbamoxybenzyl)-N,N-dimethylammonio]octane Diperchlorate	C02-A028
1-(N,N-Dimethylamino)-10-[N-(3-Dimethylcarbamoxy-2-pyridylmethyl)-N-methylamino]decane Di (Hydrogen Methosulfate)	C02-A003
1-(N,N-Dimethylamino)-10-[N-(3-Dimethylcarbamoxy-2-pyridylmethyl)-N-methylamino]decane Di (Hydrogen Methoxalate)	C02-A003
1-(N,N-Dimethylamino)-10-[N-(3-Dimethylcarbamoxy-2-pyridylmethyl)-N-methylamino]decane Di (Hydrogenoxalate)	C02-A003
1-(N,N-Dimethylamino)-10-[N-(3-Dimethylcarbamoxy-2-pyridylmethyl)-N-methylamino]decane Di (Hydrogensulfate)	C02-A003
1-(N,N-Dimethylamino)-10-[N-(3-Dimethylcarbamoxy-2-pyridylmethyl)-N-methylamino]decane Dimethobromide	C02-A003
1-(N,N-Dimethylamino)-10-[N-(3-Dimethylcarbamoxy-2-pyridylmethyl)-N-methylamino]decane Dimethohydrogenoxalate	C02-A003
1-(N,N-Dimethylamino)-10-[N-(3-Dimethylcarbamoxy-2-pyridylmethyl)-N-methylamino]decane Dimethonitrate	C02-A003
1-(N,N-Dimethylamino)-10-[N-(3-Dimethylcarbamoxy-2-pyridylmethyl)-N-methylamino]decane Dimethoperchlorate	C02-A003
1-(N,N-Dimethylamino)-10-[N-(3-Dimethylcarbamoxy-2-pyridylmethyl)-N-methylamino]decane Dimethosulfate	C02-A003
1-(N,N-Dimethyl-N-cyanomethylammonio)-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Di(Hydrogen Oxalate)	C02-A031
1-(N,N-Dimethyl-N-cyanomethylammonio)-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Di(Hydrogen Sulfate)	C02-A031
1-(N,N-Dimethyl-N-cyanomethylammonio)-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Di(Tetraphenylboronate)	C02-A031
1-(N,N-Dimethyl-N-cyanomethylammonio)-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Dibromide	C02-A031
1-(N,N-Dimethyl-N-cyanomethylammonio)-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Dinitrate	C02-A031

1-(N,N-Dimethyl-N-cyanomethylammonio)-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Diperchlorate	C02-A031
1-(N,N-Dimethyl-N-cyanomethylammonio)-10-[N-(3-dimethylcarbamoxy-a-picolinyl)-N,N-dimethylammonio]decane Di(Hydrogen Oxalate)	C02-A031
1-(N,N-Dimethyl-N-cyanomethylammonio)-10-[N-(3-dimethylcarbamoxy-a-picolinyl)-N,N-dimethylammonio]decane Di(Hydrogen Sulfate)	C02-A031
1-(N,N-Dimethyl-N-cyanomethylammonio)-10-[N-(3-dimethylcarbamoxy-a-picolinyl)-N,N-dimethylammonio]decane Di(Tetraphenylboronate)	C02-A031
1-(N,N-Dimethyl-N-cyanomethylammonio)-10-[N-(3-dimethylcarbamoxy-a-picolinyl)-N,N-dimethylammonio]decane Dibromide	C02-A031
1-(N,N-Dimethyl-N-cyanomethylammonio)-10-[N-(3-dimethylcarbamoxy-a-picolinyl)-N,N-dimethylammonio]decane Dinitrate	C02-A031
1-(N,N-Dimethyl-N-cyanomethylammonio)-10-[N-(3-dimethylcarbamoxy-a-picolinyl)-N,N-dimethylammonio]decane Diperchlorate	C02-A031
1-(N,N-Dimethyl-N-cyanomethylammonio)-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Di(Hydrogen Oxalate)	C02-A031
1-(N,N-Dimethyl-N-cyanomethylammonio)-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Di(Hydrogen Sulfate)	C02-A031
1-(N,N-Dimethyl-N-cyanomethylammonio)-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Di(Tetraphenylboronate)	C02-A031
1-(N,N-Dimethyl-N-cyanomethylammonio)-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Dibromide	C02-A031
1-(N,N-Dimethyl-N-cyanomethylammonio)-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Dinitrate	C02-A031
1-(N,N-Dimethyl-N-cyanomethylammonio)-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Diperchlorate	C02-A031
1-(N,N-Dimethyl-N-cyclohexylammonio)-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Di(Hydrogen Oxalate)	C02-A045
1-(N,N-Dimethyl-N-cyclohexylammonio)-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Di(Hydrogen Sulfate)	C02-A045
1-(N,N-Dimethyl-N-cyclohexylammonio)-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Di(Tetraphenylboronate)	C02-A045
1-(N,N-Dimethyl-N-cyclohexylammonio)-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Dibromide	C02-A045
1-(N,N-Dimethyl-N-cyclohexylammonio)-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Dinitrate	C02-A045
1-(N,N-Dimethyl-N-cyclohexylammonio)-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Diperchlorate	C02-A045
1-(N,N-Dimethyl-N-cyclohexylammonio)-10-[N-(3-dimethylcarbamoxy-a-picolinyl)-N,N-dimethylammonio]decane Di(Hydrogen Oxalate)	C02-A045
1-(N,N-Dimethyl-N-cyclohexylammonio)-10-[N-(3-dimethylcarbamoxy-a-picolinyl)-N,N-dimethylammonio]decane Di(Hydrogen Sulfate)	C02-A045
1-(N,N-Dimethyl-N-cyclohexylammonio)-10-[N-(3-dimethylcarbamoxy-a-picolinyl)-N,N-dimethylammonio]decane Di(Tetraphenylboronate)	C02-A045
1-(N,N-Dimethyl-N-cyclohexylammonio)-10-[N-(3-dimethylcarbamoxy-a-picolinyl)-N,N-dimethylammonio]decane Dibromide	C02-A045
1-(N,N-Dimethyl-N-cyclohexylammonio)-10-[N-(3-dimethylcarbamoxy-a-picolinyl)-N,N-dimethylammonio]decane Dinitrate	C02-A045
1-(N,N-Dimethyl-N-cyclohexylammonio)-10-[N-(3-dimethylcarbamoxy-a-picolinyl)-N,N-dimethylammonio]decane Diperchlorate	C02-A045

(*Continued*)

1-(N,N-Dimethyl-N-cyclohexylammonio)-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Di(Hydrogen Oxalate)	C02-A045
1-(N,N-Dimethyl-N-cyclohexylammonio)-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Di(Hydrogen Sulfate)	C02-A045
1-(N,N-Dimethyl-N-cyclohexylammonio)-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Di(Tetraphenylboronate)	C02-A045
1-(N,N-Dimethyl-N-cyclohexylammonio)-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Dibromide	C02-A045
1-(N,N-Dimethyl-N-cyclohexylammonio)-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Dinitrate	C02-A045
1-(N,N-Dimethyl-N-cyclohexylammonio)-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Diperchlorate	C02-A045
1-(N-Methyl)pyrrolidinio-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Di(Hydrogen Oxalate)	C02-A036
1-(N-Methyl)pyrrolidinio-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Di(Hydrogen Sulfate)	C02-A036
1-(N-Methyl)pyrrolidinio-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Di(Tetraphenylboronate)	C02-A036
1-(N-Methyl)pyrrolidinio-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Dibromide	C02-A036
1-(N-Methyl)pyrrolidinio-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Dinitrate	C02-A036
1-(N-Methyl)pyrrolidinio-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Diperchlorate	C02-A036
1-(N-Methyl)pyrrolidinio-10-[N-(3-dimethylcarbamoxy-a-picolinyl)-N,N-dimethylammonio]decane Di(Hydrogen Oxalate)	C02-A036
1-(N-Methyl)pyrrolidinio-10-[N-(3-dimethylcarbamoxy-a-picolinyl)-N,N-dimethylammonio]decane Di(Hydrogen Sulfate)	C02-A036
1-(N-Methyl)pyrrolidinio-10-[N-(3-dimethylcarbamoxy-a-picolinyl)-N,N-dimethylammonio]decane Di(Tetraphenylboronate)	C02-A036
1-(N-Methyl)pyrrolidinio-10-[N-(3-dimethylcarbamoxy-a-picolinyl)-N,N-dimethylammonio]decane Dibromide	C02-A036
1-(N-Methyl)pyrrolidinio-10-[N-(3-dimethylcarbamoxy-a-picolinyl)-N,N-dimethylammonio]decane Dinitrate	C02-A036
1-(N-Methyl)pyrrolidinio-10-[N-(3-dimethylcarbamoxy-a-picolinyl)-N,N-dimethylammonio]decane Diperchlorate	C02-A036
1-(N-Methyl)pyrrolidinio-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Di(Hydrogen Oxalate)	C02-A036
1-(N-Methyl)pyrrolidinio-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Di(Hydrogen Sulfate)	C02-A036
1-(N-Methyl)pyrrolidinio-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Di(Tetraphenylboronate)	C02-A036
1-(N-Methyl)pyrrolidinio-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Dibromide	C02-A036
1-(N-Methyl)pyrrolidinio-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Dinitrate	C02-A036
1-(N-Methyl)pyrrolidinio-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Diperchlorate	C02-A036
1-(Vinylsulfanyl)ethylene	C03-D051
1-(Vinylsulfinyl)ethene	C03-D050
1-(Vinylsulfonyl)ethylene	C03-D049
1,1,1,3,3,3-Hexafluoro-2-propanone	C11-A086

1,1,1,3,3,3-Hexafluoroacetone	C11-A086
1,1,1,3,3,3-Hexafluoropropan-2-one	C11-A086
1,1,1,3,3,3-Hexafluorpropan-2-on	C11-A086
1,1,1-Trichloromethane	C11-A043
1,1,1-Trichloronitromethane	C10-A006
1,1,1-Trimethylacetone	C01-C101
1,1,2,2,-Tetrachloroethane	C11-A165
1,1,2,2-Czterochloroetan	C11-A165
1,1,2,2-TCA	C11-A165
1,1,2,2-Tetrabromaethan	C11-A164
1,1,2,2-Tetrabromethan	C11-A164
1,1,2,2-Tetrabromoetan	C11-A164
1,1,2,2-Tetrabromoetano	C11-A164
1,1,2,2-Tetrabromoethane	C11-A164
1,1,2,2-Tetrabromoethylene	C11-A164
1,1,2,2-Tetrabroomethaan	C11-A164
1,1,2,2-Tetrachloorethaan	C11-A165
1,1,2,2-Tetrachloraethan	C11-A165
1,1,2,2-Tetrachlorethane	C11-A165
1,1,2,2-Tetrachloro-[1,2-2H2]ethane	C11-A165
1,1,2,2-Tetrachloroetan	C11-A165
1,1,2,2-Tetrachloroethane	C11-A165
1,1,2,2-Tetrachloroethene	C11-A136
1,1,2,2-Tetracloroetano	C11-A165
1,1,2,2-Tetrahloroetan	C11-A165
1,1,2,2-Tetrakis(chloranyl)ethane	C11-A165
1,1,2,2-Tetraklorethan	C11-A165
1,1,2,2-Tetrakloroetan	C11-A165
1,1,2-Trifluoro-2-chloroethylene	C11-A177
1,1,3,3,3-Pentafluoro-2-(trifluoromethyl)-1-propene	C10-A008
1,1,3,3,3-Pentafluoro-2-(trifluoromethyl)-prop-1-ene	C10-A008
1,1,3,3-Tetraethyl-2-[fluoro(methoxy)phosphoryl]guanidine	C01-A040
1,1,3,3-Tetraethyl-2-[fluoro(methyl)phosphoryl]guanidine	C01-A039
1,1,3,3-Tetraethylguanidine	C01-C108
1,1'-[Methylenebis(thio)]bis[2-chloroethane]	C03-A011
1,1'-[Oxybis(methylenethio)]bis[2-chloroethane]	C03-A015
1,1'-Dichlorodimethyl Ether	C10-A011
1,1'-Dimethyl-[4,4'-bipyridin]-1,1'-diium Dichloride	C11-A132
1,1'-Dimethyl-4,4'-bipyridine-1,1'-diium Chloride	C11-A132
1,1'-Dimethyl-4,4'-bipyridinium Dichloride	C11-A132
1,1'-Dimethyltriethylamine	C01-D176
1,1'-Dimetil-4,4'-bipiridina-dicloreto	C11-A132
1,1'-Methylenebis(4-isocyanatobenzene)	C11-A113
1,1'-Metilenebis(4-isosianatobenzena)	C11-A113
1,1'-Oxybis(2-chloro)ethane	C11-A017
1,1'-Oxybis[1-chloromethane]	C10-A011
1,1'-Sulfinylbis(2-chloroethane)	C03-D056
1,1'-Sulfonylbis[2-chloroethane]	C03-D055
1,1'-Sulfonylbisethene	C03-D049

(*Continued*)

1,1'-Sulfonyldiethene	C03-D049
1,1'-Sulfonyldiethylene	C03-D049
1,1'-Sulphonylbisethene	C03-D049
1,1'-Thiobis(2-chloroethane)	C03-A001
1,1'-Thiobisethene	C03-D051
1,1-Di(trifluoromethyl)-1-hydroxymethyl	C11-A086
1,1-Dibromoformaldoxime	C05-A002
1,1-Dichloro-1-fluoro-ethane	C01-C155
1,1-Dichloroformaldoxime	C05-A001
1,1-Dichloro-N-[chloro(isopropoxy)phosphoryl]oxy-methanimine	C01-C133
1,1-Dichloro-N-[chloro(methoxy)phosphoryl]oxy-methanimine	C01-C117
1,1-Dichloro-N-[chloro(propoxy)phosphoryl]oxy-methanimine	C01-C135
1,1-Dichloro-N-dichlorophosphoryloxy-methanimine	C01-C112
1,1-Dichloro-N-phenylmethanimine	C10-A013
1,1-Difluoro-2,2-bis(trifluoromethyl)ethene	C10-A008
1,1-Dimethyl-4,4-dipyridilium Dichloride	C11-A132
1,1-Dimethylethyl Isocyanate	C11-A029
1,1-Dimethylethyl Methyl Ketone	C01-C101
1,1-Sulfinyl Bisethene	C03-D050
1,2,2-Tetrabromaethan	C11-A164
1,2,2-Tetrabromoetano	C11-A164
1,2,2-Tetrabromoethane	C11-A164
1,2,2-Tetrabroomethaan	C11-A164
1,2,2-Trifluoro-1-chloroethylene	C11-A177
1,2,2-Trifluoro-1-klóretén	C11-A177
1,2,2-Trifluorochloroethylene	C11-A177
1,2,2-Trimethylpropoxyfluoromethylphosphine Oxide	C01-A003
1,2,2-Trimethylpropoxyfluorophosphine Oxide	C01-A003
1,2,2-Trimethylpropyl Methyl-d3-phosphonofluoridate	C01-A003
1,2,2-Trimethylpropyl Methylphosphonochloridate	C01-C055
1,2,2-Trimethylpropyl Methylphosphonochloridoate	C01-C055
1,2,2-Trimethylpropyl Methylphosphonofluoridate	C01-A003
1,2,2-Trimethylpropyl Methylphosphonofluoridoate	C01-A003
1,2,2-Trimethylpropyl-d13 Methylphosphonofluoridate	C01-A003
1,2,2-Trimethylpropylester Kyseliny Methylfluorfosfonove	C01-A003
1,2,2-Trimethylpropyl-tx Methylphosphonofluoridate	C01-A003
1,2,3,4,5,5-Heksakloorisyklopenta-1,3-dieeni	C11-A085
1,2,3,4,5,5-Hexachlor-cyclopenta-1,3-dien	C11-A085
1,2,3,4,5,5-Hexachloro-1,3-cyclopentadiene	C11-A085
1,2,3,4,5,5-hexachlorocyclopenta-1,3-diene	C11-A085
1,2,3,4,7,7-Hexachloro-1,5,5a,6,9,9a-hexahydro-6,9-methano-2,4,3-benzodioxathiepin-3-oxide	C11-A063
1,2,3,4,7,7-Hexachloro-5-norbornene-2,3-dimethanol, Cyclic Sulfite	C11-A063
1,2,3,4,7,7-Hexachlorobicyclo(2.2.1)-2-heptene-5,6-bisoxymethylene Sulfite	C11-A063
1,2,3,4,7,7-Hexachlorobicyclo[2.2.1]-2-heptene-5,6-bisoxymethylene Sulfite	C11-A063
1,2,3,4,7,7-Hexachlorobicyclo[2.2.1]hepten-5,6-bioxymethylene Sulfite	C11-A063
1,2,3-Benzotriazin-4(3 H)-one, 3-(mercaptomethyl)-, O,O-Dimethylphosphorodithioate	C11-A013
1,2-Bichloroethane	C11-A070
1,2-Bis(2-chloroethylmercapto) Ethane	C03-A002
1,2-Bis(2-chloroethylthio) Ethane	C03-A002
1,2-Bis(2-hydroxyethylthio)ethane	C03-D046

1,2-Bis(beta-hydroxyethylthio)ethane	C03-D046
1,2-Bis(β-hydroxyethylthio)ethane	C03-D046
1,2-DCE	C11-A070
1,2-Di(chloroethylthio) Ethane	C03-A002
1,2-Diboraethane	C11-A052
1,2-Diboraethyne	C11-A052
1,2-Dibrom-3-chlor-propan	C11-A053
1,2-Dibromaethan	C11-A069
1,2-Dibromethane	C11-A069
1,2-Dibromo-3-chloropropane	C11-A053
1,2-Dibromochloropropane	C11-A053
1,2-Dibromoetano	C11-A069
1,2-Dibromoethane	C11-A069
1,2-Dibromopropyl Chloride	C11-A053
1,2-Dibroom-3-chloorpropaan	C11-A053
1,2-Dibroomethaan	C11-A069
1,2-Dichioroethane	C11-A070
1,2-Dichloorethaan	C11-A070
1,2-Dichloraethan	C11-A070
1,2-Dichlorethan	C11-A070
1,2-Dichlorethane	C11-A070
1,2-Dichloroetane	C11-A070
1,2-Dichloroethane	C11-A070
1,2-Dichloroetharie	C11-A070
1,2-Dichloroethoxy	C11-A042
1,2-Dichoroethane	C11-A070
1,2-Dicloroetano	C11-A070
1,2-Dicloroethane	C11-A070
1,2-Dimercaptoethane	C03-D048
1,2-Dimethyldiazane	C11-A059
1,2-Dimethylhydrazine	C11-A059
1,2-Dithiocane-3,8-diol	C03-D046
1,2-Dithiolethane	C03-D048
1,2-DMH	C11-A059
1,2-Epoxy Ethane	C11-A071
1,2-Epoxyaethan	C11-A071
1,2-Epoxyethane	C11-A071
1,2-Ethandithiol	C03-D048
1,2-Ethane Dithiol	C03-D048
1,2-Ethanedithiol	C03-D048
1,2-Ethanethiol	C03-D048
1,2-Ethyl-2-(hydroxymethyl)-, Cyclic Phosphate	C06-A002
1,2-Ethylene Dibromide	C11-A069
1,2-Ethylene Dichloride	C11-A070
1,2-Ethylenedithiol	C03-D048
1,2-Ethylidene Dichloride	C11-A070
1,2-Propylene Phosphorofluoridite	C01-C157
1,2-Propyleneimine	C11-A145
1,2-Propylenimine	C11-A145

(*Continued*)

1,3,2-Dioxaphospholane, 2-Fluoro-	C01-C156
1,3-Benzodioxol-4-ol, 2,2-Dimethyl-, Methylcarbamate	C11-A014
1,3-Benzodioxole, 2,2-Dimethyl-4-(N-methylaminocarboxylato)-	C11-A014
1,3-Benzodioxole, 2,2-Dimethyl-4-(N-methylcarbamato)-	C11-A014
1,3-Bis(2-chloroethylsulfanyl)propane	C03-A014
1,3-Bis(2-chloroethylthio)-n-propane	C03-A014
1,3-Bis(2-chloroethylthio)propane	C03-A014
1,3-Bis-(carboxymethoxy)-1-propen-2-yl-dimethylfosfat	C11-A018
1,3-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]propane Di(Hydrogen Methosulfate)	C02-A007
1,3-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]propane Di(Hydrogen Methoxalate)	C02-A007
1,3-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]propane Di(Hydrogenoxalate)	C02-A007
1,3-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]propane Di(Hydrogensulfate)	C02-A007
1,3-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]propane Dihydrogenoxalate	C02-A007
1,3-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]propane Dimethobromide	C02-A007
1,3-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]propane Dimethohydrogenoxalate	C02-A007
1,3-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]propane Dimethonitrate	C02-A007
1,3-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]propane Dimethoperchlorate	C02-A007
1,3-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]propane Dimethosulfate	C02-A007
1,3-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]propane Dinitrate	C02-A007
1,3-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]propane Diperchlorate	C02-A007
1,3-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]propane Sulfate	C02-A007
1,3-Cyclopentadiene, 1,2,3,4,5,5-Hexachloro-	C11-A085
1,3-Cyclopentadiene, Hexachloro-	C11-A085
1,3-Di(methoxycarbonyl)prop-1-en-2-yl dimethyl Phosphate	C11-A018
1,3-Dibromo-3-chloropropane	C11-A053
1,3-Dicyclohexylcarbodiimide	C01-C056
1,3-Dicyclohexylurea	C01-D171
1,3-Diisocyanato-2-methylbenzene	C11-A174
1,3-Diisopropyl Carbodiimide	C01-C058
1,3-Di-iso-propylcarbodiimide	C01-C058
1,3-Propanediaminium, N,N'-Bis[[3-[[(Dimethylamino)carbonyl]oxy]-2-pyridinyl]methyl]-N,N,N',N'-tetramethyl-, Dibromide	C02-A001
1,3-Propanediaminium, N,N'-Bis[[3-[[(Dimethylamino)carbonyl]oxy]-2-pyridinyl]methyl]-N,N,N',N'-tetramethyl-, Dibromide	C02-A007
1,3-Propanediol, 2-(hydroxymethyl)-2-isopropyl-, Cyclic Phosphate	C06-A003
1,3-Propanediol, 2-(Hydroxymethyl)-2-methyl-, Cyclic Phosphate	C06-A001
1,3-Propanediol, 2-(t-Butyl)-2-(hydroxymethyl)-, Cyclic Phosphate	C06-A004
1,3-Propanediol, 2-(tert-Butyl)-2-(hydroxymethyl)-, Cyclic Phosphate	C06-A004
1,3-Propanediol, 2-Ethyl-2-(hydroxymethyl)-, Cyclic Phosphate	C06-A002
1,3-Propanediol, 2-Ethyl-2-(hydroxymethyl)-, Cyclic Phosphate	C06-A005
1,3-Propanediol, 2-Ethyl-2-(hydroxymethyl)-, Cyclic Phosphorothioate	C06-A005
1,4,5,6,7,7-Hexachloro-5-norbornene-2,3-dimethanol Cyclic Sulfite	C11-A063
1,4,5,6,7,7-Hexachloro-8,9,10-trinorborn-5-en-2,3-ylenedimethyl Sulphite	C11-A063
1,4-Bis(2-chloroethylsulfanyl)butane	C03-A012
1,4-Bis(2-chloroethylthio)butane	C03-A012
1,4-Bis(2-chloroethylthio)-n-butane	C03-A012
1,4-Bis[(2-chloroethyl)sulfanyl]butane	C03-A012
1,4-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]butane Di(Hydrogen Methoxalate)	C02-A006
1,4-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]butane Di(Hydrogenoxalate)	C02-A006
1,4-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]butane Di(Hydrogensulfate)	C02-A006

1,4-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]butane Dihydrogenoxalate	C02-A006
1,4-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]butane Dimethobromide	C02-A006
1,4-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]butane Dimethohydrogenoxalate	C02-A006
1,4-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]butane Dimethonitrate	C02-A006
1,4-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]butane Dimethoperchlorate	C02-A006
1,4-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]butane Dimethosulfate	C02-A006
1,4-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]butane Dinitrate	C02-A006
1,4-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]butane Diperchlorate	C02-A006
1,4-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]butane Sulfate	C02-A006
1,4-Butanediaminium, N,N'-Bis[[3-[[(Dimethylamino)carbonyl]oxy]-2-pyridinyl]methyl]-N,N,N',N'-tetramethyl-, Dibromide	C02-A006
1,4-Diossan-2,3-diil-bis(O,O-dietil-ditiofosfato)	C11-A061
1,4-Diossan-2,3-diyl-bis(O,O-dietil-ditiofosfato)	C11-A061
1,4-Dioxaan-2,3-diyl-bis(O,O-diethyl-dithiofosfaat)	C11-A061
1,4-Dioxan-2,3-diyl Bis(O,O-diethyl Phosphorodithioate)	C11-A061
1,4-Dioxan-2,3-diyl Bis(O,O-diethyl Phosphorothiolothionate)	C11-A061
1,4-Dioxan-2,3-diyl O,O,O',O'-Tetraethyl Di(phosphorodithioate)	C11-A061
1,4-Dioxan-2,3-diyl O,O,O',O'-Tetraethyl Di(phosphoromithioate)	C11-A061
1,4-Dioxan-2,3-diyl S,S-Di(O,O-diethyl Phosphorodithioate)	C11-A061
1,4-Dioxan-2,3-diyl-bis(O,O-diaethyl-dithiophosphat)	C11-A061
1,4-Dioxan-2,3-diyl-bis(O,O-diethyl Phosphorothiolothionate)	C11-A061
1,4-Dioxane-2,3-dithiol, S,S-Diester with O,O-Diethyl Phosphorodithioate	C11-A061
1,4-Dioxane-2,3-diyl O,O,O',O'-Tetraethyl Phosphorodithioate	C11-A061
1,4-Dioxanedithiol S,S-Bis(O,O-diethyl Phosphorodithioate)	C11-A061
1,4-Dithiacyclohexane	C03-D059
1,4-Dithiane	C03-D059
1,4-Dithiin, Tetrahydro-	C03-D059
1,4-Oxathiane	C03-D058
1,4-Oxathiin, 2,3,5,6-Tetrahydro-	C03-D058
1,4-Thioxane	C03-D058
1,5,5a,6,9,9a-Hexahydro-3-oxo-6,7,8,9,10,10-hexachloro-6,9-methano-2,4,3-benzodioxathiepin	C11-A063
1,5-Bis((2-chloroethyl)thio)pentane	C03-A013
1,5-Bis(2-chloroethylsulfanyl)pentane	C03-A013
1,5-Bis(2-chloroethylthio)-n-pentane	C03-A013
1,5-Bis(2-chloroethylthio)pentane	C03-A013
1,5-Bis-[(2-chloroethyl)sulfanyl]pentane	C03-A013
1,5-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]pentane Di(Hydrogen Methoxalate)	C02-A005
1,5-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]pentane Di(Hydrogenoxalate)	C02-A005
1,5-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]pentane Di(Hydrogensulfate)	C02-A005
1,5-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]pentane Dihydrogenoxalate	C02-A005
1,5-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]pentane Dimethobromide	C02-A005
1,5-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]pentane Dimethohydrogenoxalate	C02-A005
1,5-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]pentane Dimethonitrate	C02-A005
1,5-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]pentane Dimethoperchlorate	C02-A005
1,5-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]pentane Dimethosulfate	C02-A005
1,5-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]pentane Dinitrate	C02-A005
1,5-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]pentane Diperchlorate	C02-A005
1,5-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]pentane Sulfate	C02-A005
1,5-Dichloro-3-methyl-3-azapentane Hydrochloride	C03-A017

(*Continued*)

1,5-Dichloro-3-oxapentane	C11-A017
1,5-Dihydroxy-3-thiapentane	C03-C037
1,5-Pentanediaminium, N,N'-Bis[[3-[[(Dimethylamino)carbonyl]oxy]-2-pyridinyl]methyl]-N,N,N',N'-tetramethyl-, Dibromide	C02-A005
1,6-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]hexane Di(Hydrogen Methoxalate)	C02-A002
1,6-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]hexane Di(Hydrogenoxalate)	C02-A002
1,6-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]hexane Di(Hydrogensulfate)	C02-A002
1,6-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]hexane Dihydrogenoxalate	C02-A002
1,6-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]hexane Dimethobromide	C02-A002
1,6-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]hexane Dimethohydrogenoxalate	C02-A002
1,6-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]hexane Dimethonitrate	C02-A002
1,6-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]hexane Dimethoperchlorate	C02-A002
1,6-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]hexane Dimethosulfate	C02-A002
1,6-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]hexane Dinitrate	C02-A002
1,6-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]hexane Diperchlorate	C02-A002
1,6-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]hexane Sulfate	C02-A002
1,6-Dichloro-3,4-dithiahexane	C03-D
1,6-Hexanediaminium, N,N'-Bis[[3-[[(Dimethylamino)carbonyl]oxy]-2-pyridinyl]methyl]-N,N,N',N'-tetramethyl-, Dibromide	C02-A002
1,7-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]heptane Di(Hydrogen Methoxalate)	C02-A010
1,7-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]heptane Di(Hydrogenoxalate)	C02-A010
1,7-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]heptane Di(Hydrogensulfate)	C02-A010
1,7-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]heptane Dihydrogenoxalate	C02-A010
1,7-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]heptane Dimethobromide	C02-A010
1,7-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]heptane Dimethohydrogenoxalate	C02-A010
1,7-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]heptane Dimethonitrate	C02-A010
1,7-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]heptane Dimethoperchlorate	C02-A010
1,7-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]heptane Dimethosulfate	C02-A010
1,7-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]heptane Dinitrate	C02-A010
1,7-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]heptane Diperchlorate	C02-A010
1,7-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]heptane Sulfate	C02-A010
1,7-Heptanediaminium, N,N'-Bis[[3-[[(Dimethylamino)carbonyl]oxy]-2-pyridinyl]methyl]-N,N,N',N'-tetramethyl-, Dibromide	C02-A010
1,8-Bis[(2-Dimethylcarbamoxybenzyl)ethylamino]octane Di(Hydrogen Methosulfate)	C02-A021
1,8-Bis[(2-Dimethylcarbamoxybenzyl)ethylamino]octane Di(Hydrogen Methoxalate)	C02-A021
1,8-Bis[(2-Dimethylcarbamoxybenzyl)ethylamino]octane Di(Hydrogenoxalate)	C02-A021
1,8-Bis[(2-Dimethylcarbamoxybenzyl)ethylamino]octane Di(Hydrogensulfate)	C02-A021
1,8-Bis[(2-Dimethylcarbamoxybenzyl)ethylamino]octane Dimethobromide	C02-A021
1,8-Bis[(2-Dimethylcarbamoxybenzyl)ethylamino]octane Dimethohydrogenoxalate	C02-A021
1,8-Bis[(2-Dimethylcarbamoxybenzyl)ethylamino]octane Dimethonitrate	C02-A021
1,8-Bis[(2-Dimethylcarbamoxybenzyl)ethylamino]octane Dimethoperchlorate	C02-A021
1,8-Bis[(2-Dimethylcarbamoxybenzyl)ethylamino]octane Dimethosulfate	C02-A021
1,8-Bis[(3-Dimethylcarbamoxy-alpha-picolinyl)ethylamino]octane Di(Hydrogen Methosulfate)	C02-A018
1,8-Bis[(3-Dimethylcarbamoxy-alpha-picolinyl)ethylamino]octane Di(Hydrogen Methoxalate)	C02-A018
1,8-Bis[(3-Dimethylcarbamoxy-alpha-picolinyl)ethylamino]octane Di(Hydrogenoxalate)	C02-A018
1,8-Bis[(3-Dimethylcarbamoxy-alpha-picolinyl)ethylamino]octane Di(Hydrogensulfate)	C02-A018
1,8-Bis[(3-Dimethylcarbamoxy-alpha-picolinyl)ethylamino]octane Dimethobromide	C02-A018
1,8-Bis[(3-Dimethylcarbamoxy-alpha-picolinyl)ethylamino]octane Dimethohydrogenoxalate	C02-A018
1,8-Bis[(3-Dimethylcarbamoxy-alpha-picolinyl)ethylamino]octane Dimethonitrate	C02-A018
1,8-Bis[(3-Dimethylcarbamoxy-alpha-picolinyl)ethylamino]octane Dimethoperchlorate	C02-A018

1,8-Bis[(3-Dimethylcarbamoxy-alpha-picolinyl)ethylamino]octane Dimethosulfate	C02-A018
1,8-Bis[(3-Dimethylcarbamoxy-a-picolinyl)ethylamino]octane Di(Hydrogen Methosulfate)	C02-A018
1,8-Bis[(3-Dimethylcarbamoxy-a-picolinyl)ethylamino]octane Di(Hydrogen Methoxalate)	C02-A018
1,8-Bis[(3-Dimethylcarbamoxy-a-picolinyl)ethylamino]octane Di(Hydrogenoxalate)	C02-A018
1,8-Bis[(3-Dimethylcarbamoxy-a-picolinyl)ethylamino]octane Di(Hydrogensulfate)	C02-A018
1,8-Bis[(3-Dimethylcarbamoxy-a-picolinyl)ethylamino]octane Dimethobromide	C02-A018
1,8-Bis[(3-Dimethylcarbamoxy-a-picolinyl)ethylamino]octane Dimethohydrogenoxalate	C02-A018
1,8-Bis[(3-Dimethylcarbamoxy-a-picolinyl)ethylamino]octane Dimethonitrate	C02-A018
1,8-Bis[(3-Dimethylcarbamoxy-a-picolinyl)ethylamino]octane Dimethoperchlorate	C02-A018
1,8-Bis[(3-Dimethylcarbamoxy-a-picolinyl)ethylamino]octane Dimethosulfate	C02-A018
1,8-Bis[(3-Dimethylcarbamoxy-α-picolinyl)ethylamino]octane Di(Hydrogen Methosulfate)	C02-A018
1,8-Bis[(3-Dimethylcarbamoxy-α-picolinyl)ethylamino]octane Di(Hydrogen Methoxalate)	C02-A018
1,8-Bis[(3-Dimethylcarbamoxy-α-picolinyl)ethylamino]octane Di(Hydrogenoxalate)	C02-A018
1,8-Bis[(3-Dimethylcarbamoxy-α-picolinyl)ethylamino]octane Di(Hydrogensulfate)	C02-A018
1,8-Bis[(3-Dimethylcarbamoxy-α-picolinyl)ethylamino]octane Dimethobromide	C02-A018
1,8-Bis[(3-Dimethylcarbamoxy-α-picolinyl)ethylamino]octane Dimethohydrogenoxalate	C02-A018
1,8-Bis[(3-Dimethylcarbamoxy-α-picolinyl)ethylamino]octane Dimethonitrate	C02-A018
1,8-Bis[(3-Dimethylcarbamoxy-α-picolinyl)ethylamino]octane Dimethoperchlorate	C02-A018
1,8-Bis[(3-Dimethylcarbamoxy-α-picolinyl)ethylamino]octane Dimethosulfate	C02-A018
1,8-Bis[Methyl-2(3-dimethylcarbamoxypyridyl)methylamino]octane Di(Hydrogen Methosulfate)	C02-A004
1,8-Bis[Methyl-2(3-dimethylcarbamoxypyridyl)methylamino]octane Di(Hydrogen Methoxalate)	C02-A004
1,8-Bis[Methyl-2(3-dimethylcarbamoxypyridyl)methylamino]octane Di(Hydrogenoxalate)	C02-A004
1,8-Bis[Methyl-2(3-dimethylcarbamoxypyridyl)methylamino]octane Di(Hydrogensulfate)	C02-A004
1,8-Bis[Methyl-2(3-dimethylcarbamoxypyridyl)methylamino]octane Dihydrogenoxalate	C02-A004
1,8-Bis[Methyl-2(3-dimethylcarbamoxypyridyl)methylamino]octane Dimethobromide	C02-A004
1,8-Bis[Methyl-2(3-dimethylcarbamoxypyridyl)methylamino]octane Dimethohydrogenoxalate	C02-A004
1,8-Bis[Methyl-2(3-dimethylcarbamoxypyridyl)methylamino]octane Dimethonitrate	C02-A004
1,8-Bis[Methyl-2(3-dimethylcarbamoxypyridyl)methylamino]octane Dimethoperchlorate	C02-A004
1,8-Bis[Methyl-2(3-dimethylcarbamoxypyridyl)methylamino]octane Dimethosulfate	C02-A004
1,8-Bis[Methyl-2(3-dimethylcarbamoxypyridyl)methylamino]octane Dinitrate	C02-A004
1,8-Bis[Methyl-2(3-dimethylcarbamoxypyridyl)methylamino]octane Diperchlorate	C02-A004
1,8-Bis[Methyl-2(3-dimethylcarbamoxypyridyl)methylamino]octane Sulfate	C02-A004
1,8-Bis[N-(2-Dimethylcarbamoxybenzyl)-N,N-dimethylammonio]octane-2,7-dione Di(Hydrogen Oxalate)	C02-A016
1,8-Bis[N-(2-Dimethylcarbamoxybenzyl)-N,N-dimethylammonio]octane-2,7-dione Di(Hydrogen Sulfate)	C02-A016
1,8-Bis[N-(2-Dimethylcarbamoxybenzyl)-N,N-dimethylammonio]octane-2,7-dione Di (Tetraphenylboronate)	C02-A016
1,8-Bis[N-(2-Dimethylcarbamoxybenzyl)-N,N-dimethylammonio]octane-2,7-dione Dibromide	C02-A016
1,8-Bis[N-(2-Dimethylcarbamoxybenzyl)-N,N-dimethylammonio]octane-2,7-dione Dinitrate	C02-A016
1,8-Bis[N-(2-Dimethylcarbamoxybenzyl)-N,N-dimethylammonio]octane-2,7-dione Diperchlorate	C02-A016
1,8-Bis[N-(3-Dimethylcarbamoxy-alpha-picolyl)-N,N-dimethylammonio]octane-2,7-dione Di (Hydrogen Oxalate)	C02-A014
1,8-Bis[N-(3-Dimethylcarbamoxy-alpha-picolyl)-N,N-dimethylammonio]octane-2,7-dione Di (Hydrogen Sulfate)	C02-A014
1,8-Bis[N-(3-Dimethylcarbamoxy-alpha-picolyl)-N,N-dimethylammonio]octane-2,7-dione Di (Tetraphenylboronate)	C02-A014
1,8-Bis[N-(3-Dimethylcarbamoxy-alpha-picolyl)-N,N-dimethylammonio]octane-2,7-dione Dibromide	C02-A014
1,8-Bis[N-(3-Dimethylcarbamoxy-alpha-picolyl)-N,N-dimethylammonio]octane-2,7-dione Dinitrate	C02-A014

(*Continued*)

1,8-Bis[N-(3-Dimethylcarbamoxy-alpha-picolyl)-N,N-dimethylammonio]octane-2,7-dione Diperchlorate	C02-A014
1,8-Bis[N-(3-Dimethylcarbamoxy-a-picolyl)-N,N-dimethylammonio]octane-2,7-dione Di(Hydrogen Oxalate)	C02-A014
1,8-Bis[N-(3-Dimethylcarbamoxy-a-picolyl)-N,N-dimethylammonio]octane-2,7-dione Di(Hydrogen Sulfate)	C02-A014
1,8-Bis[N-(3-Dimethylcarbamoxy-a-picolyl)-N,N-dimethylammonio]octane-2,7-dione Di (Tetraphenylboronate)	C02-A014
1,8-Bis[N-(3-Dimethylcarbamoxy-a-picolyl)-N,N-dimethylammonio]octane-2,7-dione Dibromide	C02-A014
1,8-Bis[N-(3-Dimethylcarbamoxy-a-picolyl)-N,N-dimethylammonio]octane-2,7-dione Dinitrate	C02-A014
1,8-Bis[N-(3-Dimethylcarbamoxy-a-picolyl)-N,N-dimethylammonio]octane-2,7-dione Diperchlorate	C02-A014
1,8-Bis[N-(3-Dimethylcarbamoxy-α-picolyl)-N,N-dimethylammonio]octane-2,7-dione Di(Hydrogen Oxalate)	C02-A014
1,8-Bis[N-(3-Dimethylcarbamoxy-α-picolyl)-N,N-dimethylammonio]octane-2,7-dione Di(Hydrogen Sulfate)	C02-A014
1,8-Bis[N-(3-Dimethylcarbamoxy-α-picolyl)-N,N-dimethylammonio]octane-2,7-dione Di (Tetraphenylboronate)	C02-A014
1,8-Bis[N-(3-Dimethylcarbamoxy-α-picolyl)-N,N-dimethylammonio]octane-2,7-dione Dibromide	C02-A014
1,8-Bis[N-(3-Dimethylcarbamoxy-α-picolyl)-N,N-dimethylammonio]octane-2,7-dione Dinitrate	C02-A014
1,8-Bis[N-(3-Dimethylcarbamoxy-α-picolyl)-N,N-dimethylammonio]octane-2,7-dione Diperchlorate	C02-A014
1,8-Dichloro-3,6-dithiaoctane	C03-A002
1,8-Dihydroxy-3,6-dithiaoctane	C03-D046
1,8-Dihydroxy-3,6-dithiooctane	C03-D046
1,8-Dihydroxy-3,6-octanedithione	C03-D046
1,8-Octanediaminium, N,N'-Bis[[2-[[(Dimethylamino)carbonyl]oxy]phenyl]methyl]-N,N,N',N'-tetramethyl-2,7-dioxo-, Dibromide	C02-A016
1,8-Octanediaminium, N,N'-Bis[[2-[[(Dimethylamino)carbonyl]oxy]phenyl]methyl]-N,N'-diethyl-N,N'-dimethyl-, Dibromide	C02-A021
1,8-Octanediaminium, N,N'-Bis[[3-[[(Dimethylamino)carbonyl]oxy]-2-pyridinyl]methyl]-N,N,N',N'-tetramethyl-, Dibromide	C02-A004
1,8-Octanediaminium, N,N'-Bis[[3-[[(Dimethylamino)carbonyl]oxy]-2-pyridinyl]methyl]-N,N,N',N'-tetramethyl-2,7-dioxo-, Dibromide	C02-A014
1,8-Octanediaminium, N,N'-Bis[[3-[[(Dimethylamino)carbonyl]oxy]-2-pyridinyl]methyl]-N,N'-diethyl-N,N'-dimethyl-, Dibromide	C02-A018
1,8-Octanediaminium, N-[[2-[[(Dimethylamino)carbonyl]oxy]phenyl]methyl]-N,N,N',N',N'-pentamethyl-, Bis[Tetraphenylborate(1-)]	C02-A028
1,8-Octanediaminium, N-[[2-[[(Dimethylamino)carbonyl]oxy]phenyl]methyl]-N,N,N',N',N'-pentamethyl-, Dibromide	C02-A028
1,9,10,11,12,12-Hexachloro-4,6-dioxa-5-thiatricyclo[7.2.1.0(2,8)]dodec-10-ene 5-oxide	C11-A063
1,9-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]nonane Di(Hydrogen Methoxalate)	C02-A008
1,9-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]nonane Di(Hydrogenoxalate)	C02-A008
1,9-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]nonane Di(Hydrogensulfate)	C02-A008
1,9-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]nonane Dihydrogenoxalate	C02-A008
1,9-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]nonane Dimethobromide	C02-A008
1,9-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]nonane Dimethohydrogenoxalate	C02-A008
1,9-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]nonane Dimethonitrate	C02-A008
1,9-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]nonane Dimethoperchlorate	C02-A008
1,9-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]nonane Dimethosulfate	C02-A008
1,9-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]nonane Dinitrate	C02-A008
1,9-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]nonane Diperchlorate	C02-A008
1,9-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]nonane Sulfate	C02-A008

1,9-Nonanediaminium, N,N'-Bis[[3-[[(Dimethylamino)carbonyl]oxy]-2-pyridinyl]methyl]-N,N,N',N'-tetramethyl-, Dibromide	C02-A008
1,10-Bis[(2-Dimethylcarbamoxybenzyl)propylamino]decane Di(Hydrogen Methosulfate)	C02-A025
1,10-Bis[(2-Dimethylcarbamoxybenzyl)propylamino]decane Di(Hydrogen Methoxalate)	C02-A025
1,10-Bis[(2-Dimethylcarbamoxybenzyl)propylamino]decane Di(Hydrogenoxalate)	C02-A025
1,10-Bis[(2-Dimethylcarbamoxybenzyl)propylamino]decane Di(Hydrogensulfate)	C02-A025
1,10-Bis[(2-Dimethylcarbamoxybenzyl)propylamino]decane Dimethobromide	C02-A025
1,10-Bis[(2-Dimethylcarbamoxybenzyl)propylamino]decane Dimethohydrogenoxalate	C02-A025
1,10-Bis[(2-Dimethylcarbamoxybenzyl)propylamino]decane Dimethonitrate	C02-A025
1,10-Bis[(2-Dimethylcarbamoxybenzyl)propylamino]decane Dimethoperchlorate	C02-A025
1,10-Bis[(2-Dimethylcarbamoxybenzyl)propylamino]decane Dimethosulfate	C02-A025
1,10-Bis[(3-Dimethylcarbamoxy-alpha-picolinyl)ethylamino]decane Di(Hydrogen Methosulfate)	C02-A022
1,10-Bis[(3-Dimethylcarbamoxy-alpha-picolinyl)ethylamino]decane Di(Hydrogen Methoxalate)	C02-A022
1,10-Bis[(3-Dimethylcarbamoxy-alpha-picolinyl)ethylamino]decane Di(Hydrogenoxalate)	C02-A022
1,10-Bis[(3-Dimethylcarbamoxy-alpha-picolinyl)ethylamino]decane Di(Hydrogensulfate)	C02-A022
1,10-Bis[(3-Dimethylcarbamoxy-alpha-picolinyl)ethylamino]decane Dimethobromide	C02-A022
1,10-Bis[(3-Dimethylcarbamoxy-alpha-picolinyl)ethylamino]decane Dimethohydrogenoxalate	C02-A022
1,10-Bis[(3-Dimethylcarbamoxy-alpha-picolinyl)ethylamino]decane Dimethonitrate	C02-A022
1,10-Bis[(3-Dimethylcarbamoxy-alpha-picolinyl)ethylamino]decane Dimethoperchlorate	C02-A022
1,10-Bis[(3-Dimethylcarbamoxy-alpha-picolinyl)ethylamino]decane Dimethosulfate	C02-A022
1,10-Bis[(3-Dimethylcarbamoxy-a-picolinyl)ethylamino]decane Di(Hydrogen Methosulfate)	C02-A022
1,10-Bis[(3-Dimethylcarbamoxy-a-picolinyl)ethylamino]decane Di(Hydrogen Methoxalate)	C02-A022
1,10-Bis[(3-Dimethylcarbamoxy-a-picolinyl)ethylamino]decane Di(Hydrogenoxalate)	C02-A022
1,10-Bis[(3-Dimethylcarbamoxy-a-picolinyl)ethylamino]decane Di(Hydrogensulfate)	C02-A022
1,10-Bis[(3-Dimethylcarbamoxy-a-picolinyl)ethylamino]decane Dimethobromide	C02-A022
1,10-Bis[(3-Dimethylcarbamoxy-a-picolinyl)ethylamino]decane Dimethohydrogenoxalate	C02-A022
1,10-Bis[(3-Dimethylcarbamoxy-a-picolinyl)ethylamino]decane Dimethonitrate	C02-A022
1,10-Bis[(3-Dimethylcarbamoxy-a-picolinyl)ethylamino]decane Dimethoperchlorate	C02-A022
1,10-Bis[(3-Dimethylcarbamoxy-a-picolinyl)ethylamino]decane Dimethosulfate	C02-A022
1,10-Bis[(3-Dimethylcarbamoxy-α-picolinyl)ethylamino]decane Di(Hydrogen Methosulfate)	C02-A022
1,10-Bis[(3-Dimethylcarbamoxy-α-picolinyl)ethylamino]decane Di(Hydrogen Methoxalate)	C02-A022
1,10-Bis[(3-Dimethylcarbamoxy-α-picolinyl)ethylamino]decane Di(Hydrogenoxalate)	C02-A022
1,10-Bis[(3-Dimethylcarbamoxy-α-picolinyl)ethylamino]decane Di(Hydrogensulfate)	C02-A022
1,10-Bis[(3-Dimethylcarbamoxy-α-picolinyl)ethylamino]decane Dimethobromide	C02-A022
1,10-Bis[(3-Dimethylcarbamoxy-α-picolinyl)ethylamino]decane Dimethohydrogenoxalate	C02-A022
1,10-Bis[(3-Dimethylcarbamoxy-α-picolinyl)ethylamino]decane Dimethonitrate	C02-A022
1,10-Bis[(3-Dimethylcarbamoxy-α-picolinyl)ethylamino]decane Dimethoperchlorate	C02-A022
1,10-Bis[(3-Dimethylcarbamoxy-α-picolinyl)ethylamino]decane Dimethosulfate	C02-A022
1,10-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]decane Di(Hydrogen Methosulfate)	C02-A001
1,10-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]decane Di(Hydrogen Methoxalate)	C02-A001
1,10-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]decane Di(Hydrogenoxalate)	C02-A001
1,10-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]decane Di(Hydrogensulfate)	C02-A001
1,10-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]decane Dihydrogenoxalate	C02-A001
1,10-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]decane Dimethobromide	C02-A001
1,10-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]decane Dimethohydrogenoxalate	C02-A001
1,10-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]decane Dimethoiodide	C02-A001
1,10-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]decane Dimethonitrate	C02-A001
1,10-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]decane Dimethoperchlorate	C02-A001
1,10-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]decane Dimethosulfate	C02-A001

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1,10-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]decane Dinitrate	C02-A001
1,10-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]decane Diperchlorate	C02-A001
1,10-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]decane Sulfate	C02-A001
1,10-Bis[N-(2-Dimethylcarbamoxybenzyl)-N,N-dimethylammonio]decane-2,9-dione Di(Hydrogen Oxalate)	C02-A019
1,10-Bis[N-(2-Dimethylcarbamoxybenzyl)-N,N-dimethylammonio]decane-2,9-dione Di(Hydrogen Sulfate)	C02-A019
1,10-Bis[N-(2-Dimethylcarbamoxybenzyl)-N,N-dimethylammonio]decane-2,9-dione Di (Tetraphenylboronate)	C02-A019
1,10-Bis[N-(2-Dimethylcarbamoxybenzyl)-N,N-dimethylammonio]decane-2,9-dione Dibromide	C02-A019
1,10-Bis[N-(2-Dimethylcarbamoxybenzyl)-N,N-dimethylammonio]decane-2,9-dione Dinitrate	C02-A019
1,10-Bis[N-(2-Dimethylcarbamoxybenzyl)-N,N-dimethylammonio]decane-2,9-dione Diperchlorate	C02-A019
1,10-Bis[N-(3-Dimethylcarbamoxy-alpha-picolyl)-N,N-dimethylammonio]decane-2,9-dione Di (Hydrogen Oxalate)	C02-A017
1,10-Bis[N-(3-Dimethylcarbamoxy-alpha-picolyl)-N,N-dimethylammonio]decane-2,9-dione Di (Hydrogen Sulfate)	C02-A017
1,10-Bis[N-(3-Dimethylcarbamoxy-alpha-picolyl)-N,N-dimethylammonio]decane-2,9-dione Di (Tetraphenylboronate)	C02-A017
1,10-Bis[N-(3-Dimethylcarbamoxy-alpha-picolyl)-N,N-dimethylammonio]decane-2,9-dione Dibromide	C02-A017
1,10-Bis[N-(3-Dimethylcarbamoxy-alpha-picolyl)-N,N-dimethylammonio]decane-2,9-dione Dinitrate	C02-A017
1,10-Bis[N-(3-Dimethylcarbamoxy-alpha-picolyl)-N,N-dimethylammonio]decane-2,9-dione Diperchlorate	C02-A017
1,10-Bis[N-(3-Dimethylcarbamoxy-alpha-picolyl)-N-ethyl-N-methylammonio]decane-2,9-dione Di (Hydrogen Oxalate)	C02-A020
1,10-Bis[N-(3-Dimethylcarbamoxy-alpha-picolyl)-N-ethyl-N-methylammonio]decane-2,9-dione Di (Hydrogen Sulfate)	C02-A020
1,10-Bis[N-(3-Dimethylcarbamoxy-alpha-picolyl)-N-ethyl-N-methylammonio]decane-2,9-dione Di (Tetraphenylboronate)	C02-A020
1,10-Bis[N-(3-Dimethylcarbamoxy-alpha-picolyl)-N-ethyl-N-methylammonio]decane-2,9-dione Dibromide	C02-A020
1,10-Bis[N-(3-Dimethylcarbamoxy-alpha-picolyl)-N-ethyl-N-methylammonio]decane-2,9-dione Dinitrate	C02-A020
1,10-Bis[N-(3-Dimethylcarbamoxy-alpha-picolyl)-N-ethyl-N-methylammonio]decane-2,9-dione Diperchlorate	C02-A020
1,10-Bis[N-(3-Dimethylcarbamoxy-a-picolyl)-N,N-dimethylammonio]decane-2,9-dione Di (Hydrogen Oxalate)	C02-A017
1,10-Bis[N-(3-Dimethylcarbamoxy-a-picolyl)-N,N-dimethylammonio]decane-2,9-dione Di (Hydrogen Sulfate)	C02-A017
1,10-Bis[N-(3-Dimethylcarbamoxy-a-picolyl)-N,N-dimethylammonio]decane-2,9-dione Di (Tetraphenylboronate)	C02-A017
1,10-Bis[N-(3-Dimethylcarbamoxy-a-picolyl)-N,N-dimethylammonio]decane-2,9-dione Dibromide	C02-A017
1,10-Bis[N-(3-Dimethylcarbamoxy-a-picolyl)-N,N-dimethylammonio]decane-2,9-dione Dinitrate	C02-A017
1,10-Bis[N-(3-Dimethylcarbamoxy-a-picolyl)-N,N-dimethylammonio]decane-2,9-dione Diperchlorate	C02-A017
1,10-Bis[N-(3-Dimethylcarbamoxy-a-picolyl)-N-ethyl-N-methylammonio]decane-2,9-dione Di (Hydrogen Oxalate)	C02-A020
1,10-Bis[N-(3-Dimethylcarbamoxy-a-picolyl)-N-ethyl-N-methylammonio]decane-2,9-dione Di (Hydrogen Sulfate)	C02-A020

1,10-Bis[N-(3-Dimethylcarbamoxy-a-picolyl)-N-ethyl-N-methylammonio]decane-2,9-dione Di (Tetraphenylboronate)	C02-A020
1,10-Bis[N-(3-Dimethylcarbamoxy-a-picolyl)-N-ethyl-N-methylammonio]decane-2,9-dione Dibromide	C02-A020
1,10-Bis[N-(3-Dimethylcarbamoxy-a-picolyl)-N-ethyl-N-methylammonio]decane-2,9-dione Dinitrate	C02-A020
1,10-Bis[N-(3-Dimethylcarbamoxy-a-picolyl)-N-ethyl-N-methylammonio]decane-2,9-dione Diperchlorate	C02-A020
1,10-Bis[N-(3-Dimethylcarbamoxy-α-picolyl)-N,N-dimethylammonio]decane-2,9-dione Di (Hydrogen Oxalate)	C02-A017
1,10-Bis[N-(3-Dimethylcarbamoxy-α-picolyl)-N,N-dimethylammonio]decane-2,9-dione Di (Hydrogen Sulfate)	C02-A017
1,10-Bis[N-(3-Dimethylcarbamoxy-α-picolyl)-N,N-dimethylammonio]decane-2,9-dione Di (Tetraphenylboronate)	C02-A017
1,10-Bis[N-(3-Dimethylcarbamoxy-α-picolyl)-N,N-dimethylammonio]decane-2,9-dione Dibromide	C02-A017
1,10-Bis[N-(3-Dimethylcarbamoxy-α-picolyl)-N,N-dimethylammonio]decane-2,9-dione Dinitrate	C02-A017
1,10-Bis[N-(3-Dimethylcarbamoxy-α-picolyl)-N,N-dimethylammonio]decane-2,9-dione Diperchlorate	C02-A017
1,10-Bis[N-(3-Dimethylcarbamoxy-α-picolyl)-N-ethyl-N-methylammonio]d ecane-2,9-dione Dibromide	C02-A020
1,10-Bis[N-(3-Dimethylcarbamoxy-α-picolyl)-N-ethyl-N-methylammonio]decane-2,9-dione Di (Hydrogen Oxalate)	C02-A020
1,10-Bis[N-(3-Dimethylcarbamoxy-α-picolyl)-N-ethyl-N-methylammonio]decane-2,9-dione Di (Hydrogen Sulfate)	C02-A020
1,10-Bis[N-(3-Dimethylcarbamoxy-α-picolyl)-N-ethyl-N-methylammonio]decane-2,9-dione Di (Tetraphenylboronate)	C02-A020
1,10-Bis[N-(3-Dimethylcarbamoxy-α-picolyl)-N-ethyl-N-methylammonio]decane-2,9-dione Dinitrate	C02-A020
1,10-Bis[N-(3-Dimethylcarbamoxy-α-picolyl)-N-ethyl-N-methylammonio]decane-2,9-dione Diperchlorate	C02-A020
1,10-Bis{[10-(3-dimethylcarbamoxy-alpha-picolinyl)methylaminodecyl]methylamino}decane Tetrametho(hydrogenoxalate)	C02-A049
1,10-Bis{[10-(3-dimethylcarbamoxy-alpha-picolinyl)methylaminodecyl]methylamino}decane Tetrametho(hydrogensulfate)	C02-A049
1,10-Bis{[10-(3-dimethylcarbamoxy-alpha-picolinyl)methylaminodecyl]methylamino}decane Tetrametho(tetraphenylboronate)	C02-A049
1,10-Bis{[10-(3-dimethylcarbamoxy-alpha-picolinyl)methylaminodecyl]methylamino}decane Tetramethobromide	C02-A049
1,10-Bis{[10-(3-dimethylcarbamoxy-alpha-picolinyl)methylaminodecyl]methylamino}decane Tetramethonitrate	C02-A049
1,10-Bis{[10-(3-dimethylcarbamoxy-alpha-picolinyl)methylaminodecyl]methylamino}decane Tetramethoperchlorate	C02-A049
1,10-Bis{[10-(3-dimethylcarbamoxy-a-picolinyl)methylaminodecyl]methylamino}decane Tetrametho(hydrogenoxalate)	C02-A049
1,10-Bis{[10-(3-dimethylcarbamoxy-a-picolinyl)methylaminodecyl]methylamino}decane Tetrametho(hydrogensulfate)	C02-A049
1,10-Bis{[10-(3-dimethylcarbamoxy-a-picolinyl)methylaminodecyl]methylamino}decane Tetrametho(tetraphenylboronate)	C02-A049
1,10-Bis{[10-(3-dimethylcarbamoxy-a-picolinyl)methylaminodecyl]methylamino}decane Tetramethobromide	C02-A049
1,10-Bis{[10-(3-dimethylcarbamoxy-a-picolinyl)methylaminodecyl]methylamino}decane Tetramethonitrate	C02-A049

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1,10-Bis{[10-(3-dimethylcarbamoxy-a-picolinyl)methylaminodecyl]methylamino}decane Tetramethoperchlorate	C02-A049
1,10-Bis{[10-(3-dimethylcarbamoxy-α-picolinyl)methylaminodecyl]methylamino}decane Tetrametho(hydrogenoxalate)	C02-A049
1,10-Bis{[10-(3-dimethylcarbamoxy-α-picolinyl)methylaminodecyl]methylamino}decane Tetrametho(hydrogensulfate)	C02-A049
1,10-Bis{[10-(3-dimethylcarbamoxy-α-picolinyl)methylaminodecyl]methylamino}decane Tetrametho(tetraphenylboronate)	C02-A049
1,10-Bis{[10-(3-dimethylcarbamoxy-α-picolinyl)methylaminodecyl]methylamino}decane tetramethobromide	C02-A049
1,10-Bis{[10-(3-dimethylcarbamoxy-α-picolinyl)methylaminodecyl]methylamino}decane Tetramethonitrate	C02-A049
1,10-Bis{[10-(3-dimethylcarbamoxy-α-picolinyl)methylaminodecyl]methylamino}decane Tetramethoperchlorate	C02-A049
1,10-Bis{N-[1-(2-dimethylcarbamoxyphenyl)ethyl]-N,N-dimethylammonio}decane-2,9-dione Di (hydrogen Oxalate)	C02-A023
1,10-Bis{N-[1-(2-dimethylcarbamoxyphenyl)ethyl]-N,N-dimethylammonio}decane-2,9-dione Di (hydrogen Sulfate)	C02-A023
1,10-Bis{N-[1-(2-dimethylcarbamoxyphenyl)ethyl]-N,N-dimethylammonio}decane-2,9-dione Di (tetraphenylboronate)	C02-A023
1,10-Bis{N-[1-(2-dimethylcarbamoxyphenyl)ethyl]-N,N-dimethylammonio}decane-2,9-dione Dinitrate	C02-A023
1,10-Bis{N-[1-(2-dimethylcarbamoxyphenyl)ethyl]-N,N-dimethylammonio}decane-2,9-dione Diperchlorate	C02-A023
1,10-Bis{N-[1-(2-dimethylcarbamoxyphenyl)ethyl]-N,N-dimethylammonio}decane-2,9-dione Tetraphenylboronate	C02-A023
1,10-Decanediaminium, N-(3-Cyanopropyl)-N'-[[3-[[(dimethylamino)carbonyl]oxy]-2-pyridinyl] methyl]-N,N,N',N'-tetramethyl-, Dibromide	C02-A041
1,10-Decanediaminium, N-(Carboxymethyl)-N'-[[3-[[(dimethylamino)carbonyl]oxy]-2-pyridinyl] methyl]-N,N,N',N'-tetramethyl-, Dibromide	C02-A032
1,10-Decanediaminium, N-(Cyanomethyl)-N'-[[3-[[(dimethylamino)carbonyl]oxy]-2-pyridinyl] methyl]-N,N,N',N'-tetramethyl-, Dibromide	C02-A031
1,10-Decanediaminium, N,N,N-Tributyl-N'-[[3-[[(dimethylamino)carbonyl]oxy]-2-pyridinyl] methyl]-N',N'-dimethyl-, Dibromide	C02-A047
1,10-Decanediaminium, N,N'-Bis[[2-[[(Dimethylamino)carbonyl]oxy]phenyl]methyl]-N,N,N',N'-tetramethyl-2,9-dioxo-, Dibromide	C02-A019
1,10-Decanediaminium, N,N'-Bis[[2-[[(Dimethylamino)carbonyl]oxy]phenyl]methyl]-N,N,N',N'-tetraethyl-, Dibromide	C02-A025
1,10-Decanediaminium, N,N'-Bis[[3-[[(Dimethylamino)carbonyl]oxy]-2-pyridinyl]methyl]-N,N,N',N'-tetramethyl-, Diiodide	C02-A001
1,10-Decanediaminium, N,N'-Bis[[3-[[(Dimethylamino)carbonyl]oxy]-2-pyridinyl]methyl]-N,N,N',N'-tetramethyl-2,9-dioxo-, Dibromide	C02-A017
1,10-Decanediaminium, N,N'-Bis[[3-[[(Dimethylamino)carbonyl]oxy]-2-pyridinyl]methyl]-N,N'-diethyl-N,N'-dimethyl-2,9-dioxo-, Dibromide	C02-A020
1,10-Decanediaminium, N,N'-Bis[[3-[[(Dimethylamino)carbonyl]oxy]-2-pyridinyl]methyl]-N,N'-diethyl-N,N'-dimethyl-, Dibromide	C02-A022
1,10-Decanediaminium, N,N'-Bis[1-[2-[[(Dimethylamino)carbonyl]oxy]phenyl]ethyl]-N,N,N',N'-tetramethyl-2,9-dioxo-, Bis[Tetraphenylborate(1-)]	C02-A023
1,10-Decanediaminium, N,N'-Bis[10-[[[3-[[(Dimethylamino)carbonyl]oxy]-2-pyridinyl]methyl] dimethylammonio]decyl]-N,N,N',N'-tetramethyl-, Tetraphenylborate(1-)	C02-A049
1,10-Decanediaminium, N-[[2-[[(Dimethylamino)carbonyl]oxy]phenyl]methyl]-N,N,N',N',N'-pentamethyl-, Dibromide	C02-A033

1,10-Decanediaminium, N-[[3-[[(Dimethylamino)carbonyl]oxy]-2-pyridinyl]methyl]-N,N,N',N',N'-pentamethyl-, Dibromide	C02-A003
1,10-Decanediaminium, N-[[3-[[(Dimethylamino)carbonyl]oxy]-2-pyridinyl]methyl]-N'-(2-hydroxyethyl)-N,N,N',N'-tetramethyl-, Dibromide	C02-A034
1,10-Decanediaminium, N-[[3-[[(Dimethylamino)carbonyl]oxy]-2-pyridinyl]methyl]-N'-(3-hydroxypropyl)-N,N,N',N'-tetramethyl-, Dibromide	C02-A037
1,10-Decanediaminium, N-[[3-[[(dimethylamino)carbonyl]oxy]-2-pyridinyl]methyl]-N',N'-bis(2-hydroxyethyl)-N,N,N'-trimethyl-, Bis[Tetraphenylborate(1-)]	C02-A038
1,10-Decanediaminium, N-[[3-[[(dimethylamino)carbonyl]oxy]-2-pyridinyl]methyl]-N',N'-bis(2-hydroxyethyl)-N,N,N'-trimethyl-, Dibromide	C02-A038
1,10-Decanediaminium, N-[[3-[[(Dimethylamino)carbonyl]oxy]-2-pyridinyl]methyl]-N'-[(3-hydroxy-2-pyridinyl)methyl]-N,N,N',N'-tetramethyl-, Bis[Tetraphenylborate(1-)]	C02-A044
1,10-Decanediaminium, N-[[3-[[(Dimethylamino)carbonyl]oxy]-2-pyridinyl]methyl]-N'-[(3-hydroxy-2-pyridinyl)methyl]-N,N,N',N'-tetramethyl-, Dibromide	C02-A044
1,10-Decanediaminium, N-[[3-[[(Dimethylamino)carbonyl]oxy]-2-pyridinyl]methyl]-N,N,N',N'-tetramethyl-N'-[2-(1-oxobutoxy)ethyl]-, Dibromide	C02-A046
1,10-Decanediaminium, N-[[4-[[[(Dimethylamino)carbonyl]oxy]methyl]phenyl]methyl]-N'-[[3-[[(dimethylamino)carbonyl]oxy]-2-pyridinyl]methyl]-N,N,N',N'-tetramethyl-, Bis [Tetraphenylborate(1-)]	C02-A048
1,10-Decanediaminium, N-[[4-[[[(Dimethylamino)carbonyl]oxy]methyl]phenyl]methyl]-N'-[[3-[[(dimethylamino)carbonyl]oxy]-2-pyridinyl]methyl]-N,N,N',N'-tetramethyl-, Dibromide	C02-A048
1,10-Decanediaminium, N-[2-(Acetyloxy)propyl]-N'-[[3-[[(dimethylamino)carbonyl]oxy]-2-pyridinyl]methyl]-N,N,N',N'-tetramethyl-, Dibromide	C02-A043
1,10-Decanediaminium, N-[2-(Acetyloxy)propyl]-N'-[[3-[[(dimethylamino)carbonyl]oxy]-2-pyridinyl]methyl]-N,N,N',N'-tetramethyl-, Tetraphenylborate(1-)	C02-A043
1,10-Decanediaminium, N-Cyclohexyl-N'-[[3-[[(dimethylamino)carbonyl]oxy]-2-pyridinyl]methyl]-N,N,N',N'-tetramethyl-, Dibromide	C02-A045
1,10-Dioxa-4,7-dithiadecane	C03-D046
1,11-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]undecane Di(Hydrogen Methoxalate)	C02-A009
1,11-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]undecane Di(Hydrogenoxalate)	C02-A009
1,11-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]undecane Di(Hydrogensulfate)	C02-A009
1,11-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]undecane Dihydrogenoxalate	C02-A009
1,11-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]undecane Dimethobromide	C02-A009
1,11-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]undecane Dimethohydrogenoxalate	C02-A009
1,11-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]undecane Dimethonitrate	C02-A009
1,11-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]undecane Dimethoperchlorate	C02-A009
1,11-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]undecane Dimethosulfate	C02-A009
1,11-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]undecane Dinitrate	C02-A009
1,11-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]undecane Diperchlorate	C02-A009
1,11-Bis[Methyl-2-(3-dimethylcarbamoxypyridyl)methylamino]undecane Sulfate	C02-A009
1,11-Undecanediaminium, N,N'-Bis[[3-[[(Dimethylamino)carbonyl]oxy]-2-pyridinyl]methyl]-N,N,N',N'-tetramethyl-, Dibromide	C02-A009
1-[Butoxy(methyl)phosphoryl]oxybutane	C01-C092
1-[Ethoxy(ethyl)phosphoryl]oxyethane	C01-C090
1-[Ethoxy(methyl)phosphoryl]oxyethane	C01-C089
1-[Ethoxy(sulfanyl)phosphoryl]oxyethane	C01-C074
1-[Ethylsulfanyl(methyl)phosphoryl]oxyethane	C01-D169
1-[N-(2-Dimethylcarbamoxybenzyl)pyrrolinio]-10-(N,N,N-trimethylammonio)decane Di(Hydrogen Oxalate)	C02-A040

(*Continued*)

1-[N-(2-Dimethylcarbamoxybenzyl)pyrrolinio]-10-(N,N,N-trimethylammonio)decane Di(Hydrogen Sulfate)	C02-A040
1-[N-(2-Dimethylcarbamoxybenzyl)pyrrolinio]-10-(N,N,N-trimethylammonio)decane Di (Tetraphenylboronate)	C02-A040
1-[N-(2-Dimethylcarbamoxybenzyl)pyrrolinio]-10-(N,N,N-trimethylammonio)decane Dibromide	C02-A040
1-[N-(2-Dimethylcarbamoxybenzyl)pyrrolinio]-10-(N,N,N-trimethylammonio)decane Dinitrate	C02-A040
1-[N-(2-Dimethylcarbamoxybenzyl)pyrrolinio]-10-(N,N,N-trimethylammonio)decane Diperchlorate	C02-A040
1-[N-(2-Dimethylcarbamoxybenzyl)pyrrolinio]-8-(N,N,N-trimethylammonio)octane Di(Hydrogen Oxalate)	C02-A030
1-[N-(2-Dimethylcarbamoxybenzyl)pyrrolinio]-8-(N,N,N-trimethylammonio)octane Di(Hydrogen Sulfate)	C02-A030
1-[N-(2-Dimethylcarbamoxybenzyl)pyrrolinio]-8-(N,N,N-trimethylammonio)octane Di (Tetraphenylboronate)	C02-A030
1-[N-(2-Dimethylcarbamoxybenzyl)pyrrolinio]-8-(N,N,N-trimethylammonio)octane Dibromide	C02-A030
1-[N-(2-Dimethylcarbamoxybenzyl)pyrrolinio]-8-(N,N,N-trimethylammonio)octane Dinitrate	C02-A030
1-[N-(2-Dimethylcarbamoxybenzyl)pyrrolinio]-8-(N,N,N-trimethylammonio)octane Diperchlorate	C02-A030
1-[N-(3-Dimethylcarbamoxy-alpha-picolyl)-N,N-dimethylammonio]-10-(N-carbamoxymethyl-N,N-dimethylammonio)decane Di(Hydrogen Oxylate)	C02-A032
1-[N-(3-Dimethylcarbamoxy-alpha-picolyl)-N,N-dimethylammonio]-10-(N-carbamoxymethyl-N,N-dimethylammonio)decane Di(Hydrogen Sulfate)	C02-A032
1-[N-(3-Dimethylcarbamoxy-alpha-picolyl)-N,N-dimethylammonio]-10-(N-carbamoxymethyl-N,N-dimethylammonio)decane Di(tetraphenylboronate)	C02-A032
1-[N-(3-Dimethylcarbamoxy-alpha-picolyl)-N,N-dimethylammonio]-10-(N-carbamoxymethyl-N,N-dimethylammonio)decane Dibromide	C02-A032
1-[N-(3-Dimethylcarbamoxy-alpha-picolyl)-N,N-dimethylammonio]-10-(N-carbamoxymethyl-N,N-dimethylammonio)decane Dinitrate	C02-A032
1-[N-(3-Dimethylcarbamoxy-alpha-picolyl)-N,N-dimethylammonio]-10-(N-carbamoxymethyl-N,N-dimethylammonio)decane Diperchlorate	C02-A032
1-[N-(3-Dimethylcarbamoxy-a-picolyl)-N,N-dimethylammonio]-10-(N-carbamoxymethyl-N,N-dimethylammonio)decane Di(Hydrogen Oxylate)	C02-A032
1-[N-(3-Dimethylcarbamoxy-a-picolyl)-N,N-dimethylammonio]-10-(N-carbamoxymethyl-N,N-dimethylammonio)decane Di(Hydrogen Sulfate)	C02-A032
1-[N-(3-Dimethylcarbamoxy-a-picolyl)-N,N-dimethylammonio]-10-(N-carbamoxymethyl-N,N-dimethylammonio)decane Di(tetraphenylboronate)	C02-A032
1-[N-(3-Dimethylcarbamoxy-a-picolyl)-N,N-dimethylammonio]-10-(N-carbamoxymethyl-N,N-dimethylammonio)decane Dibromide	C02-A032
1-[N-(3-Dimethylcarbamoxy-a-picolyl)-N,N-dimethylammonio]-10-(N-carbamoxymethyl-N,N-dimethylammonio)decane Dinitrate	C02-A032
1-[N-(3-Dimethylcarbamoxy-a-picolyl)-N,N-dimethylammonio]-10-(N-carbamoxymethyl-N,N-dimethylammonio)decane Diperchlorate	C02-A032
1-[N-(3-Dimethylcarbamoxy-α-picolyl)-N,N-dimethylammonio]-10-(N-carbamoxymethyl-N,N-dimethylammonio)decane Di(Hydrogen Oxylate)	C02-A032
1-[N-(3-Dimethylcarbamoxy-α-picolyl)-N,N-dimethylammonio]-10-(N-carbamoxymethyl-N,N-dimethylammonio)decane Di(Hydrogen Sulfate)	C02-A032
1-[N-(3-Dimethylcarbamoxy-α-picolyl)-N,N-dimethylammonio]-10-(N-carbamoxymethyl-N,N-dimethylammonio)decane Di(Tetraphenylboronate)	C02-A032
1-[N-(3-Dimethylcarbamoxy-α-picolyl)-N,N-dimethylammonio]-10-(N-carbamoxymethyl-N,N-dimethylammonio)decane Dibromide	C02-A032
1-[N-(3-Dimethylcarbamoxy-α-picolyl)-N,N-dimethylammonio]-10-(N-carbamoxymethyl-N,N-dimethylammonio)decane Dinitrate	C02-A032
1-[N-(3-Dimethylcarbamoxy-α-picolyl)-N,N-dimethylammonio]-10-(N-carbamoxymethyl-N,N-dimethylammonio)decane Diperchlorate	C02-A032

1-[N-(3-Hydroxy-alpha-picolyl)-N,N-dimethylammonio]-10-[N-(3-dimethylcarbamoxy-alpha-picolyl)-N,N-dimethylammonio]decane Di(Hydrogen Oxalate)	C02-A044
1-[N-(3-Hydroxy-alpha-picolyl)-N,N-dimethylammonio]-10-[N-(3-dimethylcarbamoxy-alpha-picolyl)-N,N-dimethylammonio]decane Di(Hydrogen Sulfate)	C02-A044
1-[N-(3-Hydroxy-alpha-picolyl)-N,N-dimethylammonio]-10-[N-(3-dimethylcarbamoxy-alpha-picolyl)-N,N-dimethylammonio]decane Di(Tetraphenylboronate)	C02-A044
1-[N-(3-Hydroxy-alpha-picolyl)-N,N-dimethylammonio]-10-[N-(3-dimethylcarbamoxy-alpha-picolyl)-N,N-dimethylammonio]decane Dibromide	C02-A044
1-[N-(3-Hydroxy-alpha-picolyl)-N,N-dimethylammonio]-10-[N-(3-dimethylcarbamoxy-alpha-picolyl)-N,N-dimethylammonio]decane Dinitrate	C02-A044
1-[N-(3-Hydroxy-alpha-picolyl)-N,N-dimethylammonio]-10-[N-(3-dimethylcarbamoxy-alpha-picolyl)-N,N-dimethylammonio]decane Diperchlorate	C02-A044
1-[N-(3-Hydroxy-a-picolyl)-N,N-dimethylammonio]-10-[N-(3-dimethylcarbamoxy-a-picolyl)-N,N-dimethylammonio]decane Di(Hydrogen Oxalate)	C02-A044
1-[N-(3-Hydroxy-a-picolyl)-N,N-dimethylammonio]-10-[N-(3-dimethylcarbamoxy-a-picolyl)-N,N-dimethylammonio]decane Di(Hydrogen Sulfate)	C02-A044
1-[N-(3-Hydroxy-a-picolyl)-N,N-dimethylammonio]-10-[N-(3-dimethylcarbamoxy-a-picolyl)-N,N-dimethylammonio]decane Di(Tetraphenylboronate)	C02-A044
1-[N-(3-Hydroxy-a-picolyl)-N,N-dimethylammonio]-10-[N-(3-dimethylcarbamoxy-a-picolyl)-N,N-dimethylammonio]decane Dibromide	C02-A044
1-[N-(3-Hydroxy-a-picolyl)-N,N-dimethylammonio]-10-[N-(3-dimethylcarbamoxy-a-picolyl)-N,N-dimethylammonio]decane Dinitrate	C02-A044
1-[N-(3-Hydroxy-a-picolyl)-N,N-dimethylammonio]-10-[N-(3-dimethylcarbamoxy-a-picolyl)-N,N-dimethylammonio]decane Diperchlorate	C02-A044
1-[N-(3-Hydroxy-α-picolyl)-N,N-dimethylammonio]-10-[N-(3-dimethylcarbamoxy-α-picolyl)-N,N-dimethylammonio]decane Di(Hydrogen Oxalate)	C02-A044
1-[N-(3-Hydroxy-α-picolyl)-N,N-dimethylammonio]-10-[N-(3-dimethylcarbamoxy-α-picolyl)-N,N-dimethylammonio]decane Di(Hydrogen Sulfate)	C02-A044
1-[N-(3-Hydroxy-α-picolyl)-N,N-dimethylammonio]-10-[N-(3-dimethylcarbamoxy-α-picolyl)-N,N-dimethylammonio]decane Di(Tetraphenylboronate)	C02-A044
1-[N-(3-Hydroxy-α-picolyl)-N,N-dimethylammonio]-10-[N-(3-dimethylcarbamoxy-α-picolyl)-N,N-dimethylammonio]decane Dibromide	C02-A044
1-[N-(3-Hydroxy-α-picolyl)-N,N-dimethylammonio]-10-[N-(3-dimethylcarbamoxy-α-picolyl)-N,N-dimethylammonio]decane Dinitrate	C02-A044
1-[N-(3-Hydroxy-α-picolyl)-N,N-dimethylammonio]-10-[N-(3-dimethylcarbamoxy-α-picolyl)-N,N-dimethylammonio]decane Diperchlorate	C02-A044
1-[N-(4-Dimethylcarbamoxymethyl)benzyl-N,N-dimethylammonio]-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Di(Hydrogen Sulfate)	C02-A048
1-[N-(4-Dimethylcarbamoxymethyl)benzyl-N,N-dimethylammonio]-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Di(Tetraphenylboronate)	C02-A048
1-[N-(4-Dimethylcarbamoxymethyl)benzyl-N,N-dimethylammonio]-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Dibromide	C02-A048
1-[N-(4-Dimethylcarbamoxymethyl)benzyl-N,N-dimethylammonio]-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Dinitrate	C02-A048
1-[N-(4-Dimethylcarbamoxymethyl)benzyl-N,N-dimethylammonio]-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Diperchlorate	C02-A048
1-[N-(4-Dimethylcarbamoxymethyl)benzyl-N,N-dimethylammonio]-10-[N-(3-dimethylcarbamoxy-a-picolinyl)-N,N-dimethylammonio]decane Di(Hydrogen Sulfate)	C02-A048
1-[N-(4-Dimethylcarbamoxymethyl)benzyl-N,N-dimethylammonio]-10-[N-(3-dimethylcarbamoxy-a-picolinyl)-N,N-dimethylammonio]decane Di(Tetraphenylboronate)	C02-A048

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1-[N-(4-Dimethylcarbamoxymethyl)benzyl-N,N-dimethylammonio]-10-[N-(3-dimethylcarbamoxy-a-picolinyl)-N,N-dimethylammonio]decane Dibromide	C02-A048
1-[N-(4-Dimethylcarbamoxymethyl)benzyl-N,N-dimethylammonio]-10-[N-(3-dimethylcarbamoxy-a-picolinyl)-N,N-dimethylammonio]decane Dinitrate	C02-A048
1-[N-(4-Dimethylcarbamoxymethyl)benzyl-N,N-dimethylammonio]-10-[N-(3-dimethylcarbamoxy-a-picolinyl)-N,N-dimethylammonio]decane Diperchlorate	C02-A048
1-[N-(4-Dimethylcarbamoxymethyl)benzyl-N,N-dimethylammonio]-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Di(Hydrogen Sulfate)	C02-A048
1-[N-(4-Dimethylcarbamoxymethyl)benzyl-N,N-dimethylammonio]-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Di(Tetraphenylboronate)	C02-A048
1-[N-(4-Dimethylcarbamoxymethyl)benzyl-N,N-dimethylammonio]-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Dibromide	C02-A048
1-[N-(4-Dimethylcarbamoxymethyl)benzyl-N,N-dimethylammonio]-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Dinitrate	C02-A048
1-[N-(4-Dimethylcarbamoxymethyl)benzyl-N,N-dimethylammonio]-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Diperchlorate	C02-A048
1-[N,N-Di(2-hydroxy)ethyl-N-methylammonio]-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Diperchlorate	C02-A038
1-[N,N-Di(2-hydroxy)ethyl-N-methylammonio]-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Diperchlorate	C02-A038
1-[N,N-Di(2-hydroxy)ethyl-N-methylammonio]-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Di(Hydrogen Oxalate)	C02-A038
1-[N,N-Di(2-hydroxy)ethyl-N-methylammonio]-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Di(Hydrogen Sulfate)	C02-A038
1-[N,N-Di(2-hydroxy)ethyl-N-methylammonio]-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Di(Tetraphenylboronate)	C02-A038
1-[N,N-Di(2-hydroxy)ethyl-N-methylammonio]-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Dibromide	C02-A038
1-[N,N-Di(2-hydroxy)ethyl-N-methylammonio]-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Dinitrate	C02-A038
1-[N,N-Di(2-hydroxy)ethyl-N-methylammonio]-10-[N-(3-dimethylcarbamoxy-a-picolinyl)-N,N-dimethylammonio]decane Di(Hydrogen Oxalate)	C02-A038
1-[N,N-Di(2-hydroxy)ethyl-N-methylammonio]-10-[N-(3-dimethylcarbamoxy-a-picolinyl)-N,N-dimethylammonio]decane Di(Hydrogen Sulfate)	C02-A038
1-[N,N-Di(2-hydroxy)ethyl-N-methylammonio]-10-[N-(3-dimethylcarbamoxy-a-picolinyl)-N,N-dimethylammonio]decane Di(Tetraphenylboronate)	C02-A038
1-[N,N-Di(2-hydroxy)ethyl-N-methylammonio]-10-[N-(3-dimethylcarbamoxy-a-picolinyl)-N,N-dimethylammonio]decane Dibromide	C02-A038
1-[N,N-Di(2-hydroxy)ethyl-N-methylammonio]-10-[N-(3-dimethylcarbamoxy-a-picolinyl)-N,N-dimethylammonio]decane Dinitrate	C02-A038
1-[N,N-Di(2-hydroxy)ethyl-N-methylammonio]-10-[N-(3-dimethylcarbamoxy-a-picolinyl)-N,N-dimethylammonio]decane Diperchlorate	C02-A038
1-[N,N-Di(2-hydroxy)ethyl-N-methylammonio]-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Di(Hydrogen Oxalate)	C02-A038
1-[N,N-Di(2-hydroxy)ethyl-N-methylammonio]-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Di(Hydrogen Sulfate)	C02-A038
1-[N,N-Di(2-hydroxy)ethyl-N-methylammonio]-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Di(Tetraphenylboronate)	C02-A038
1-[N,N-Di(2-hydroxy)ethyl-N-methylammonio]-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Dibromide	C02-A038
1-[N,N-Di(2-hydroxy)ethyl-N-methylammonio]-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Dinitrate	C02-A038

1-[N,N-Dimethyl-N-(2-acetoxy-2-methylethyl)ammonio]-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Di(Hydrogen Oxalate)	C02-A043
1-[N,N-Dimethyl-N-(2-acetoxy-2-methylethyl)ammonio]-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Di(Hydrogen Sulfate)	C02-A043
1-[N,N-Dimethyl-N-(2-acetoxy-2-methylethyl)ammonio]-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Di(Tetraphenylboronate)	C02-A043
1-[N,N-Dimethyl-N-(2-acetoxy-2-methylethyl)ammonio]-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Dinitrate	C02-A043
1-[N,N-Dimethyl-N-(2-acetoxy-2-methylethyl)ammonio]-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Diperchlorate	C02-A043
1-[N,N-Dimethyl-N-(2-acetoxy-2-methylethyl)ammonio]-10-[N-(3-dimethylcarbamoxy-a-picolinyl)-N,N-dimethylammonio]decane Di(Hydrogen Oxalate)	C02-A043
1-[N,N-Dimethyl-N-(2-acetoxy-2-methylethyl)ammonio]-10-[N-(3-dimethylcarbamoxy-a-picolinyl)-N,N-dimethylammonio]decane Di(Hydrogen Sulfate)	C02-A043
1-[N,N-Dimethyl-N-(2-acetoxy-2-methylethyl)ammonio]-10-[N-(3-dimethylcarbamoxy-a-picolinyl)-N,N-dimethylammonio]decane Di(Tetraphenylboronate)	C02-A043
1-[N,N-Dimethyl-N-(2-acetoxy-2-methylethyl)ammonio]-10-[N-(3-dimethylcarbamoxy-a-picolinyl)-N,N-dimethylammonio]decane Dinitrate	C02-A043
1-[N,N-Dimethyl-N-(2-acetoxy-2-methylethyl)ammonio]-10-[N-(3-dimethylcarbamoxy-a-picolinyl)-N,N-dimethylammonio]decane Diperchlorate	C02-A043
1-[N,N-Dimethyl-N-(2-acetoxy-2-methylethyl)ammonio]-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Di(Hydrogen Oxalate)	C02-A043
1-[N,N-Dimethyl-N-(2-acetoxy-2-methylethyl)ammonio]-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Di(Hydrogen Sulfate)	C02-A043
1-[N,N-Dimethyl-N-(2-acetoxy-2-methylethyl)ammonio]-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Di(Tetraphenylboronate)	C02-A043
1-[N,N-Dimethyl-N-(2-acetoxy-2-methylethyl)ammonio]-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Dibromide	C02-A043
1-[N,N-Dimethyl-N-(2-acetoxy-2-methylethyl)ammonio]-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Dinitrate	C02-A043
1-[N,N-Dimethyl-N-(2-acetoxy-2-methylethyl)ammonio]-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Diperchlorate	C02-A043
1-[N,N-Dimethyl-N-(2-butyroxyethyl)ammonio]-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl-N,N-dimethylammonio]decane Di(Hydrogen Oxalate)	C02-A046
1-[N,N-Dimethyl-N-(2-butyroxyethyl)ammonio]-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl-N,N-dimethylammonio]decane Di(Hydrogen Sulfate)	C02-A046
1-[N,N-Dimethyl-N-(2-butyroxyethyl)ammonio]-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl-N,N-dimethylammonio]decane Di(Tetraphenylboronate)	C02-A046
1-[N,N-Dimethyl-N-(2-butyroxyethyl)ammonio]-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl-N,N-dimethylammonio]decane Dibromide	C02-A046
1-[N,N-Dimethyl-N-(2-butyroxyethyl)ammonio]-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl-N,N-dimethylammonio]decane Dinitrate	C02-A046
1-[N,N-Dimethyl-N-(2-butyroxyethyl)ammonio]-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl-N,N-dimethylammonio]decane Diperchlorate	C02-A046
1-[N,N-Dimethyl-N-(2-butyroxyethyl)ammonio]-10-[N-(3-dimethylcarbamoxy-a-picolinyl-N,N-dimethylammonio]decane Di(Hydrogen Oxalate)	C02-A046
1-[N,N-Dimethyl-N-(2-butyroxyethyl)ammonio]-10-[N-(3-dimethylcarbamoxy-a-picolinyl-N,N-dimethylammonio]decane Di(Hydrogen Sulfate)	C02-A046
1-[N,N-Dimethyl-N-(2-butyroxyethyl)ammonio]-10-[N-(3-dimethylcarbamoxy-a-picolinyl-N,N-dimethylammonio]decane Di(Tetraphenylboronate)	C02-A046

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1-[N,N-Dimethyl-N-(2-butyroxyethyl)ammonio]-10-[N-(3-dimethylcarbamoxy-a-picolinyl-N,N-dimethylammonio]decane Dibromide	C02-A046
1-[N,N-Dimethyl-N-(2-butyroxyethyl)ammonio]-10-[N-(3-dimethylcarbamoxy-a-picolinyl-N,N-dimethylammonio]decane Dinitrate	C02-A046
1-[N,N-Dimethyl-N-(2-butyroxyethyl)ammonio]-10-[N-(3-dimethylcarbamoxy-a-picolinyl-N,N-dimethylammonio]decane Diperchlorate	C02-A046
1-[N,N-Dimethyl-N-(2-butyroxyethyl)ammonio]-10-[N-(3-dimethylcarbamoxy-α-picolinyl-N,N-dimethylammonio]decane Di(Hydrogen Oxalate)	C02-A046
1-[N,N-Dimethyl-N-(2-butyroxyethyl)ammonio]-10-[N-(3-dimethylcarbamoxy-α-picolinyl-N,N-dimethylammonio]decane Di(Hydrogen Sulfate)	C02-A046
1-[N,N-Dimethyl-N-(2-butyroxyethyl)ammonio]-10-[N-(3-dimethylcarbamoxy-α-picolinyl-N,N-dimethylammonio]decane Di(Tetraphenylboronate)	C02-A046
1-[N,N-Dimethyl-N-(2-butyroxyethyl)ammonio]-10-[N-(3-dimethylcarbamoxy-α-picolinyl-N,N-dimethylammonio]decane Dibromide	C02-A046
1-[N,N-Dimethyl-N-(2-butyroxyethyl)ammonio]-10-[N-(3-dimethylcarbamoxy-α-picolinyl-N,N-dimethylammonio]decane Dinitrate	C02-A046
1-[N,N-Dimethyl-N-(2-butyroxyethyl)ammonio]-10-[N-(3-dimethylcarbamoxy-α-picolinyl-N,N-dimethylammonio]decane Diperchlorate	C02-A046
1-[N,N-Dimethyl-N-(2-hydroxy)ethylammonio]-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Di(Hydrogen Oxalate)	C02-A034
1-[N,N-Dimethyl-N-(2-hydroxy)ethylammonio]-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Di(Hydrogen Sulfate)	C02-A034
1-[N,N-Dimethyl-N-(2-hydroxy)ethylammonio]-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Di(Tetraphenylboronate)	C02-A034
1-[N,N-Dimethyl-N-(2-hydroxy)ethylammonio]-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Dibromide	C02-A034
1-[N,N-Dimethyl-N-(2-hydroxy)ethylammonio]-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Dinitrate	C02-A034
1-[N,N-Dimethyl-N-(2-hydroxy)ethylammonio]-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Diperchlorate	C02-A034
1-[N,N-Dimethyl-N-(2-hydroxy)ethylammonio]-10-[N-(3-dimethylcarbamoxy-a-picolinyl)-N,N-dimethylammonio]decane Di(Hydrogen Oxalate)	C02-A034
1-[N,N-Dimethyl-N-(2-hydroxy)ethylammonio]-10-[N-(3-dimethylcarbamoxy-a-picolinyl)-N,N-dimethylammonio]decane Di(Hydrogen Sulfate)	C02-A034
1-[N,N-Dimethyl-N-(2-hydroxy)ethylammonio]-10-[N-(3-dimethylcarbamoxy-a-picolinyl)-N,N-dimethylammonio]decane Di(Tetraphenylboronate)	C02-A034
1-[N,N-Dimethyl-N-(2-hydroxy)ethylammonio]-10-[N-(3-dimethylcarbamoxy-a-picolinyl)-N,N-dimethylammonio]decane Dibromide	C02-A034
1-[N,N-Dimethyl-N-(2-hydroxy)ethylammonio]-10-[N-(3-dimethylcarbamoxy-a-picolinyl)-N,N-dimethylammonio]decane Dinitrate	C02-A034
1-[N,N-Dimethyl-N-(2-hydroxy)ethylammonio]-10-[N-(3-dimethylcarbamoxy-a-picolinyl)-N,N-dimethylammonio]decane Diperchlorate	C02-A034
1-[N,N-Dimethyl-N-(2-hydroxy)ethylammonio]-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Di(Hydrogen Oxalate)	C02-A034
1-[N,N-Dimethyl-N-(2-hydroxy)ethylammonio]-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Di(Hydrogen Sulfate)	C02-A034
1-[N,N-Dimethyl-N-(2-hydroxy)ethylammonio]-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Di(Tetraphenylboronate)	C02-A034
1-[N,N-Dimethyl-N-(2-hydroxy)ethylammonio]-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Dibromide	C02-A034
1-[N,N-Dimethyl-N-(2-hydroxy)ethylammonio]-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Dinitrate	C02-A034

1-[N,N-Dimethyl-N-(2-hydroxy)ethylammonio]-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Diperchlorate	C02-A034
1-[N,N-Dimethyl-N-(3-cyanopropyl)ammonio]-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Di(Hydrogen Oxalate)	C02-A041
1-[N,N-Dimethyl-N-(3-cyanopropyl)ammonio]-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Di(Hydrogen Sulfate)	C02-A041
1-[N,N-Dimethyl-N-(3-cyanopropyl)ammonio]-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Dibromide	C02-A041
1-[N,N-Dimethyl-N-(3-cyanopropyl)ammonio]-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Dinitrate	C02-A041
1-[N,N-Dimethyl-N-(3-cyanopropyl)ammonio]-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Diperchlorate	C02-A041
1-[N,N-Dimethyl-N-(3-cyanopropyl)ammonio]-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Tetraphenylboronate	C02-A041
1-[N,N-Dimethyl-N-(3-cyanopropyl)ammonio]-10-[N-(3-dimethylcarbamoxy-a-picolinyl)-N,N-dimethylammonio]decane Di(Hydrogen Oxalate)	C02-A041
1-[N,N-Dimethyl-N-(3-cyanopropyl)ammonio]-10-[N-(3-dimethylcarbamoxy-a-picolinyl)-N,N-dimethylammonio]decane Di(Hydrogen Sulfate)	C02-A041
1-[N,N-Dimethyl-N-(3-cyanopropyl)ammonio]-10-[N-(3-dimethylcarbamoxy-a-picolinyl)-N,N-dimethylammonio]decane Dibromide	C02-A041
1-[N,N-Dimethyl-N-(3-cyanopropyl)ammonio]-10-[N-(3-dimethylcarbamoxy-a-picolinyl)-N,N-dimethylammonio]decane Dinitrate	C02-A041
1-[N,N-Dimethyl-N-(3-cyanopropyl)ammonio]-10-[N-(3-dimethylcarbamoxy-a-picolinyl)-N,N-dimethylammonio]decane Diperchlorate	C02-A041
1-[N,N-Dimethyl-N-(3-cyanopropyl)ammonio]-10-[N-(3-dimethylcarbamoxy-a-picolinyl)-N,N-dimethylammonio]decane Tetraphenylboronate	C02-A041
1-[N,N-Dimethyl-N-(3-cyanopropyl)ammonio]-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Di(Hydrogen Oxalate)	C02-A041
1-[N,N-Dimethyl-N-(3-cyanopropyl)ammonio]-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Di(Hydrogen Sulfate)	C02-A041
1-[N,N-Dimethyl-N-(3-cyanopropyl)ammonio]-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Dibromide	C02-A041
1-[N,N-Dimethyl-N-(3-cyanopropyl)ammonio]-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Dinitrate	C02-A041
1-[N,N-Dimethyl-N-(3-cyanopropyl)ammonio]-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Diperchlorate	C02-A041
1-[N,N-Dimethyl-N-(3-cyanopropyl)ammonio]-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Tetraphenylboronate	C02-A041
1-[N,N-Dimethyl-N-(3-hydroxy)propylammonio]-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Di(Hydrogen Oxalate)	C02-A037
1-[N,N-Dimethyl-N-(3-hydroxy)propylammonio]-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Di(Hydrogen Sulfate)	C02-A037
1-[N,N-Dimethyl-N-(3-hydroxy)propylammonio]-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Di(Tetraphenylboronate)	C02-A037
1-[N,N-Dimethyl-N-(3-hydroxy)propylammonio]-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Dibromide	C02-A037
1-[N,N-Dimethyl-N-(3-hydroxy)propylammonio]-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Dinitrate	C02-A037
1-[N,N-Dimethyl-N-(3-hydroxy)propylammonio]-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Diperchlorate	C02-A037

(*Continued*)

1-[N,N-Dimethyl-N-(3-hydroxy)propylammonio]-10-[N-(3-dimethylcarbamoxy-a-picolinyl)-N,N-dimethylammonio]decane Di(Hydrogen Oxalate)	C02-A037
1-[N,N-Dimethyl-N-(3-hydroxy)propylammonio]-10-[N-(3-dimethylcarbamoxy-a-picolinyl)-N,N-dimethylammonio]decane Di(Hydrogen Sulfate)	C02-A037
1-[N,N-Dimethyl-N-(3-hydroxy)propylammonio]-10-[N-(3-dimethylcarbamoxy-a-picolinyl)-N,N-dimethylammonio]decane Di(Tetraphenylboronate)	C02-A037
1-[N,N-Dimethyl-N-(3-hydroxy)propylammonio]-10-[N-(3-dimethylcarbamoxy-a-picolinyl)-N,N-dimethylammonio]decane Dibromide	C02-A037
1-[N,N-Dimethyl-N-(3-hydroxy)propylammonio]-10-[N-(3-dimethylcarbamoxy-a-picolinyl)-N,N-dimethylammonio]decane Dinitrate	C02-A037
1-[N,N-Dimethyl-N-(3-hydroxy)propylammonio]-10-[N-(3-dimethylcarbamoxy-a-picolinyl)-N,N-dimethylammonio]decane Diperchlorate	C02-A037
1-[N,N-Dimethyl-N-(3-hydroxy)propylammonio]-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Di(Hydrogen Oxalate)	C02-A037
1-[N,N-Dimethyl-N-(3-hydroxy)propylammonio]-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Di(Hydrogen Sulfate)	C02-A037
1-[N,N-Dimethyl-N-(3-hydroxy)propylammonio]-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Di(Tetraphenylboronate)	C02-A037
1-[N,N-Dimethyl-N-(3-hydroxy)propylammonio]-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Dibromide	C02-A037
1-[N,N-Dimethyl-N-(3-hydroxy)propylammonio]-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Dinitrate	C02-A037
1-[N,N-Dimethyl-N-(3-hydroxy)propylammonio]-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Diperchlorate	C02-A037
1-1'-Dimetil-4-4'-bipiridinio Dicloruro	C11-A132
1-Amino-2-methoxybenzene	C11-A010
1-Aminocyclohexane	C11-A048
1-Aminoethane	C11-A068
1-Aminoprop-2-ene	C11-A005
1-Azoniabicyclo[2.2.2]octane, 1-[10-[[[3-[[(Dimethylamino)carbonyl]oxy]-2-pyridinyl]methyl]dimethylammonio]decyl]-3-hydroxy-, Dibromide	C02-A042
1-Azoniabicyclo[2.2.2]octane, 1-[10-[[2-[[(Dimethylamino)carbonyl]oxy]ethyl]dimethylammonio]decyl]-3-hydroxy-, Dibromide	C02-A013
1-Bromomethane	C11-A110
1-Bromo-N-hydroxymethanecarbonimidoyl Bromide	C05-A002
1-Butanamine, N,N-Bis(2-chloroethyl)-	C03-A036
1-Butanamine, N,N-Dibutyl-	C01-C067
1-Butyl Isocyanate	C11-A028
1-Chlor-2-[(chlormethyl)sulfanyl]ethan	C03-A008
1-Chlorethyl	C11-A180
1-Chloro-1,2,2-trifluoroethene	C11-A177
1-Chloro-1,2,2-trifluoroethylene	C11-A177
1-Chloro-1-methoxy-methane	C11-A044
1-Chloro-2-({[(2-chloroethyl)sulfanyl]methyl}sulfanyl)ethane	C03-A011
1-Chloro-2-({2-[(2-chloroethyl)sulfanyl]ethyl}sulfanyl)ethane	C03-A002
1-Chloro-2-(2-chloroethanesulfonyl)ethane	C03-D055
1-Chloro-2-(2-chloroethoxy)ethane	C11-A017
1-Chloro-2-(2-chloroethylsulfanyl)ethane	C03-A001
1-Chloro-2-(2-chloroethylsulfanyl)ethane; 1-(2-Chloroethylsulfanyl)-2-[2-(2-chloroethylsulfanyl)ethoxy]ethane	C03-A005
1-Chloro-2-(2-chloroethylsulfanylmethoxymethylsulfanyl)ethane	C03-A015

1-Chloro-2-(2-chloroethylsulfanylmethylsulfanyl)ethane	C03-A011
1-Chloro-2-(2-chloroethylsulfinyl)ethane	C03-D056
1-Chloro-2-(2-chloroethylsulfonyl)ethane	C03-D055
1-Chloro-2-(2-chloroethyltrisulfanyl)ethane	C03-D057
1-Chloro-2-(beta-chloroethoxy)ethane	C11-A017
1-Chloro-2(beta-chloroethylthio)ethane	C03-A001
1-Chloro-2-(diisopropylamino)ethane	C01-C
1-Chloro-2-(dimethylamino)ethane	C01-C099
1-Chloro-2-(dimethylamino)ethane Hydrochloride	C01-C099
1-Chloro-2-(β-chloroethoxy)ethane	C11-A017
1-Chloro-2(β-chloroethylthio)ethane	C03-A001
1-Chloro-2,3-dibromopropane	C11-A053
1-Chloro-2-[(chloromethyl)thio]ethane	C03-A008
1-Chloro-2-di-chloroarsinoethane	C04-A002
1-Chloro-2-dimethylaminoethane Monohydrochloride	C01-C099
1-Chloro-2-ethenylsulfanylethane	C03-D054
1-Chloro-2-ethenylsulfinylethane	C03-D053
1-Chloro-2-hydroxyethane	C03-C041
1-Chloro-2-methyl-2-propene	C11-A102
1-Chloro-2-N,N-dimethylaminoethane	C01-C099
1-Chloro-2-N,N-dimethylaminoethane Hydrochloride	C01-C099
1-Chloroethene	C11-A180
1-Chloroethylene	C11-A180
1-Chloro-N-[chloro-(2-chloro-1-methyl-propoxy)phosphoryl]oxy-formimidoyl Fluoride	C01-C143
1-Chloro-N-[chloro(2-chloroethoxy)phosphoryl]oxy-formimidoyl Fluoride	C01-C121
1-Chloro-N-[chloro(ethoxy)phosphoryl]oxy-formimidoyl Fluoride	C01-C123
1-Chloro-N-[chloro(isopropoxy)phosphoryl]oxy-formimidoyl Fluoride	C01-C129
1-Chloro-N-[chloro(methoxy)phosphoryl]oxy-formimidoyl Fluoride	C01-C115
1-Chloro-N-[chloro(propoxy)phosphoryl]oxy-formimidoyl Fluoride	C01-C130
1-Chloro-N-dibromophosphoryloxy-formimidoyl Fluoride	C01-C109
1-Chloro-N-dichlorophosphoryloxy-formimidoyl Fluoride	C01-C111
1-Chloro-N-phenylmethanecarbonimidoyl Chloride	C10-A013
1-Chlorotrifluoroethylene	C11-A177
1-Cyano-1-methylethane	C11-A095
1-Cyano-3-(methylmercurio)guanidine	C11-A119
1-Cyclohexylamine	C11-A048
1-Dichlorophosphorylethane	C01-C094
1-Dichloro-phosphoryl-ethane	C01-C094
1-Dichlorophosphoryloxyethane	C01-C160
1-Dichlorophosphorylpropane	C01-C095
1-Difluorophosphorylethane	C01-C
1-Difluorophosphoryloxyethane	C01-C160
1-Dimethylamino-2-chloroethane	C01-C099
1-Dimethylamino-2-propyl N,N-Dimethylphosphoramidofluoridate	C01-A
1-Ethenesulfinyl-2-chloro-ethane	C03-D053
1-Ethenylsulfinylethene	C03-D050
1-Ethenylsulfonylethene	C03-D049
1-Ethyl-1-phospha-2,6,7-trioxabicyclo(2.2.2)octane 1-Oxide	C06-A002
1-Fluoroethan-2-ol	C11-A079

(*Continued*)

1-Formylpropene	C11-A047
1H-Azirine, Dihydro-	C11-A072
1H-Pyrrolium, 1-[[2-[[(Dimethylamino)carbonyl]oxy]phenyl]methyl]-2,5-dihydro-1-[8-(trimethylammonio)octyl]-, Bis[Tetraphenylborate(1-)]	C02-A030
1H-Pyrrolium, 1-[[2-[[(Dimethylamino)carbonyl]oxy]phenyl]methyl]-2,5-dihydro-1-[8-(trimethylammonio)octyl]-, Dibromide	C02-A030
1H-Pyrrolium, 1-[[2-[[(Dimethylamino)carbonyl]oxy]phenyl]methyl]-2,5-dihydro-1-[10-(trimethylammonio)decyl]-, Bis[Tetraphenylborate(1-)]	C02-A040
1H-Pyrrolium, 1-[[2-[[(Dimethylamino)carbonyl]oxy]phenyl]methyl]-2,5-dihydro-1-[10-(trimethylammonio)decyl]-, Dibromide	C02-A040
1-Hydroxy-2,3,4,5,6-pentachlorobenzene	C11-A134
1-Hydroxy-2-propene	C11-A004
1-Hydroxypentachlorobenzene	C11-A134
1-Hydroxypentacholorobenzene	C11-A134
1-Isocianato-4-[(4-fenilisocianato)metil]benzene	C11-A113
1-Isocianato-4-[(4-fenilisocianato)metil]benzeno	C11-A113
1-Isocyanato-4-(4-isocyanatobenzyl)benzene	C11-A113
1-Isocyanato-4-[(4-isocyanatophenyl)methyl]benzene	C11-A113
1-Isocyanatobutane	C11-A028
1-Kloori-1,2,2-trifluorieteeni	C11-A177
1-Mercaptooctane	C11-A130
1-Methoxycarbonyl-1-propen-2-yl Dimethyl Phosphate	C11-A123
1-Methyl-1-cyanoethylene	C11-A101
1-Methyl-2,2-dimethylpropanol	C01-C102
1-Methyl-2,2-dimethylpropylmethylphosphonofluoridate	C01-A003
1-Methyl-4-(1-methylpyridin-1-ium-4-yl)pyridin-1-ium Dichloride	C11-A132
1-Methyl-4-phospha-3,5,8-trioxabicyclo[2.2.2]octane 4-Oxide	C06-A001
1-Methylethyl Bicyclic Phosphate	C06-A003
1-Methylethyl Chlorocarbonate	C11-A093
1-Methylethyl Chloroformate	C11-A093
1-Methylethyl Ethylfluorophosphinate	C01-A004
1-Methylethyl Ethylphosphonofluoridate	C01-A004
1-Methylethyl Ethylphosphonofluoridoate	C01-A004
1-Methylethyl Isocyanate	C11-A094
1-Methylethyl Methylphosphonochloridate	C01-C054
1-Methylethyl Methylphosphonofluoridate	C01-A002
1-Methylethylamine	C01-C100
1-Methylethylphosphonic Difluoride	C01-C068
1-Methylethylphosphonyldifluoride	C01-C068
1-Methylhydrazine	C11-A116
1-Methylpropyl Chloroformate	C11-A027
1-Methylthioethlidenaminmethylcarbamat	C11-A107
1-Methylthioethylideen-aminomethylcarbamaat	C11-A107
1-Octanethiol	C11-A130
1-Octanthiol	C11-A130
1-Octyl Mercaptan	C11-A130
1-Octyl Thiol	C11-A130
1-Oxa-4-azaciclohexano	C11-A141
1-Oxa-4-azacyclohexane	C11-A141
1-Oxa-4-thiacyclohexane	C03-D058

1-Oxo-4-isopropyl-2,6,7-trioxa-1-phosphabicyclo[2.2.2]octane	C06-A003
1-Oxo-4-methyl-2,6,7-trioxa-1-phosphabicyclo[2.2.2]octane	C06-A001
1-Oxo-4-t-Butyl-2,6,7-trioxa-1-phosphabicyclo[2.2.2]octane	C06-A004
1-Propanamine, 2-Chloro-N-(2-chloroethyl)-N-methyl-	C03-A025
1-Propanamine, 2-Chloro-N-(2-chloropropyl)-N-methyl-	C03-A031
1-Propanamine, 3-Chloro-N,N-bis(2-chloroethyl)-	C03-A028
1-Propanamine, N,N-Bis(2-chloroethyl)-	C03-A030
1-Propanamine, N,N-Bis(2-chloroethyl)-2-methyl-	C03-A035
1-Propanephosphonic Dichloride	C01-C095
1-Propanephosphonyl Chloride	C01-C095
1-Propen-3-ol	C11-A004
1-Propene, 3-Chloro-2-methyl-	C11-A102
1-Propene, 3-Isothiocyanato-	C11-A007
1-Propene,1,1,3,3,3-pentafluoro-2-(trifluoromethyl)-	C10-A008
1-Propene-3-ol	C11-A004
1-Propenol-3	C11-A004
1-Pyridinio-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Dibromide	C02-A035
1-Pyridinio-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Di (Hydrogen Oxalate)	C02-A035
1-Pyridinio-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Di (Hydrogen Sulfate)	C02-A035
1-Pyridinio-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Dinitrate	C02-A035
1-Pyridinio-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Diperchlorate	C02-A035
1-Pyridinio-10-[N-(3-dimethylcarbamoxy-alpha-picolinyl)-N,N-dimethylammonio]decane Di (Tetraphenylboronate)	C02-A035
1-Pyridinio-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Dibromide	C02-A035
1-Pyridinio-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Di(Hydrogen Oxalate)	C02-A035
1-Pyridinio-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Di(Hydrogen Sulfate)	C02-A035
1-Pyridinio-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Dinitrate	C02-A035
1-Pyridinio-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Diperchlorate	C02-A035
1-Pyridinio-10-[N-(3-dimethylcarbamoxy-α-picolinyl)-N,N-dimethylammonio]decane Di (Tetraphenylboronate)	C02-A035
1-Thia-4-oxacyclohexane	C03-D058
1-Thio-4-ethyl-2,6,7-trioxa-1-phosphabicyclo-[2.2.2]-octane	C06-A005
2 Red Star (British WWI Cylinder Gas) {Hydrogen Sulfide (90%) and Carbon Disulfide (10%) Mixture}	C07-A006
2-((Dimethylamino)methyl)pyridin-3-ol	C02-C053
2-(1-Methylethoxy)phenol Methylcarbamate	C11-A143
2-(1-Methylethoxy)phenyl Methyl Carbamate	C11-A143
2-(1-Methylethoxy)phenyl N-Methylcarbamate	C11-A143
2-(1-Metiletossi)fenil Metilcarbammato	C11-A143
2(2'-Dichloroethyl)methylamine	C03-A017
2-(2-Chloroethoxy)ethyl Chloride	C11-A017
2-(2-Hydroxyethylamino)ethanol	C03-D060
2-(Bis(1-methylethyl)amino)ethanethiol	C01-C105

(*Continued*)

2-(Bis(isopropyl)amino)ethanethiol	C01-C105
2-(Chloromethyl)-1-propene	C11-A102
2-(Diethylamino)ethanol	C01-C103
2-(Diethylamino)ethyl Alcohol	C01-C103
2-(Diisopropylamino)ethane Thiol	C01-C105
2-(Diisopropylamino)ethanol	C01-C104
2-(Diisopropylamino)ethyl Alcohol	C01-C104
2-(Diisopropylamino)ethyl Chloride	C01-C
2-(Diisopropylamino)ethyl Ethyl Methylphosphonite	C01-C064
2-(Dimethylamino)-1-chloroethane	C01-C099
2-(Dimethylamino)chloroethane Hydrochloride	C01-C099
2-(Dimethylamino)ethyl Chloride	C01-C099
2-(Dimethylamino)ethyl Chloride Hydrochloride	C01-C099
2-(Dimethylamino)ethylsulfanyl-methylphosphinic Acid	C01-D178
2-(Dimethylamino)-N-[[(methylamino)carbonyl]oxy]-2-oxoethanimidothioic Acid Methyl Ester	C11-A147
2-(Dimethylaminomethyl)-3-hydroxypyridine	C02-C053
2(E)-Butenal	C11-A047
2-(Hydroxymethyl)-2-ethyl-1,3-propanediol, Cyclic Phosphate	C06-A002
2-(Hydroxymethyl)-2-ethyl-1,3-propanediol, Cyclic Phosphorothioate	C06-A005
2-(Hydroxymethyl)-2-isopropyl-1,3-propanediol, Cyclic Phosphate	C06-A003
2-(N,N-Diethylamino)ethanol	C01-C103
2-(N,N-Diisopropylamino)ethanethiol	C01-C105
2-(N,N-Diisopropylamino)ethanol	C01-C104
2-(N,N-Diisopropylamino)ethyl Chloride	C01-C
2-(N,N-Dimethylamino)ethyl Chloride Hydrochloride	C01-C099
2-(N-2-Hydroxyethyl-N-methylamino)ethanol	C03-C043
2-(N-Ethyl-N-2-hydroxyethylamino)ethanol	C03-C044
2-(t-Butyl)-2-(hydroxymethyl)-1,3-propanediol, Cyclic Phosphate	C06-A004
2-(tert-Butyl)-2-(hydroxymethyl)-1,3-propanediol, Cyclic Phosphate	C06-A004
2,2-(Ethylenedithio)die	C03-D046
2,2-(Methylimino)diethanol	C03-C043
2,2,2-Nitrilotriethanol	C03-C045
2,2,2-Trichloroacetyl Chloride	C11-A175
2,2,2-Trifluoro-1-(trifluoromethyl)ethoxy	C11-A086
2,2,2-Trifluoroacetyl Chloride	C11-A176
2,2,2-Trifluorotriethylamine	C03-A024
2,2,2-Triklooriasetyylikloridi	C11-A175
2,2,2-Tris(chloranyl)ethanoyl Chloride	C11-A175
2,2'-(Ethane-1,2-diylbis(sulfanediyl))diethanol	C03-D046
2,2'-(Ethylazanediyl)diethanol	C03-C044
2,2'-(Ethylenedithio)diethanol	C03-D046
2,2'-(Ethylimino)bisethanol	C03-C044
2,2'-(Ethylimino)diethanol	C03-C044
2,2'-(Éthylimino)diéthanol	C03-C044
2,2'-(Methylimino)bis[ethanol]	C03-C043
2,2'-(Methylimino)bisethanol Hydrochloride	C03-C043
2,2',2"-Nitriloethanol	C03-C045
2,2',2"-Nitrilotriethanol	C03-C045
2,2',2"-Tribromotriethylamine	C03-A021
2,2',2"-Trichlorotriethylamine	C03-A018

2,2',2"-Trichlorotriethylamine Hydrochloride	C03-A018
2,2',2"-Trichlorotriethylamine Picrate	C03-A018
2,2',2"-Trifluorotriethylamine	C03-A024
2,2',2"-Trihydroxytriethylamine	C03-C045
2,2',2''-Nitrilotrisethanol	C03-C045
2,2',2''-Trichlorotriethylamine	C03-A018
2,2'-[1,2-Ethanediylbis(thio)]bisethanol	C03-D046
2,2'-Azanediyldiethanol	C03-D060
2,2'-Bis(2-chloroethylthio)diethyl Ether	C03-A003
2,2'-Dichloro-N-2-(chloroethyl)-dipropylamine	C03-A032
2,2'-Dichloro-2''-fluorotriethylamine	C03-A022
2,2'-Dichloro-1''-methyltriethylamine	C03-A029
2,2'-Difluorodiethylsulfide	C03-A
2,2'-Dichlorodiethyl Sulfide	C03-A001
2,2'-Dichlorodiethyl Sulphide	C03-A001
2,2'-Dichloroethyl Sulfide	C03-A001
2,2'-Dichloroethyl Sulphide	C03-A001
2,2'-Dichlorotriethylamine	C03-A016
2,2'-Dichloro-N-methyldiethylamine	C03-A017
2,2'-Dichloro-N-methyldiethylamine Hydrochloride	C03-A017
2,2'-Difluoro-N-methyldiethylamine	C03-A019
2,2'-Dihydroxydiethyl Sulfide	C03-C037
2,2'-Dihydroxytriethylamine	C03-C044
2,2'-Dichlorodiethyl Disulfide	C03-D
2,2'-Dichloroethyl Disulfide	C03-D
2,2'-Dihydroxydiethylamine	C03-D060
2,2'-Dichloorethylether	C11-A017
2,2'-Dichlor-diaethylaether	C11-A017
2,2'-Dichlorethyl Ether	C11-A017
2,2'-Dichlorodiethyl Ether	C11-A017
2,2'-Dichloroethyl Ether	C11-A017
2,2'-Dicloroetiletere	C11-A017
2,2'-Ethyliminodiethanol	C03-C044
2,2'-Methyliminodiethanol	C03-C043
2,2'-Methyliminodiethanolamine	C03-C043
2,2'-Thiobisethanol	C03-C037
2,2'-Thiodiethanol	C03-C037
2,2'-Thiodiglycol	C03-C037
2,2-Bis(chloranyl)ethenyl Dimethyl Phosphate	C11-A055
2,2-Dichlorobinyldimethyl Phosphate	C11-A055
2,2-Dichloroethenyl Dimethyl Phosphate	C11-A055
2,2-Dichloroethenyl Phosphoric Acid Dimethyl Ester	C11-A055
2,2-Dichloro-N-[(chloroethoxyphosphinyl)oxy]ethanimidoyl Chloride	C01-C128
2,2-Dichloro-N-[(dichlorophosphinyl)oxy]ethanimidoyl Chloride	C01-C119
2,2-Dichloro-N-[chloro(ethoxy)phosphoryl]oxy-acetimidoyl Chloride	C01-C128
2,2-Dichloro-N-dichlorophosphoryloxy-acetimidoyl Chloride	C01-C119
2,2-Dichlorovinyl Alcohol Dimethyl Phosphate	C11-A055
2,2-Dichlorovinyl Dimethyl Phosphate	C11-A055
2,2-Dichlorovinyl Dimethyl Phosphoric Acid Ester	C11-A055

(*Continued*)

2,2-Dichlorovinyl Dimethylphosphate	C11-A055
2,2-Dichlorovinyl-O,O- Dimethyl Phosphate	C11-A055
2,2-Dichlorovinyl-O,O-dimethyl phosphate	C11-A055
2,2-Difluoro-N-[(fluoromethoxyphosphinyl)oxy]-2-nitroethanimidoyl Fluoride	C01-A044
2,2-Dimethyl-1,3-benzdioxol-4-yl N-Methylcarbamate	C11-A014
2,2-Dimethyl-1,3-benzodioxol-4-ol Methylcarbamate	C11-A014
2,2-Dimethyl-1,3-benzodioxol-4-yl Methylcarbamate	C11-A014
2,2-Dimethyl-1,3-benzodioxol-4-yl N-Methylcarbamate	C11-A014
2,2-Dimethyl-2,3-dihydro-1-benzofuran-7-yl Methylcarbamate	C11-A032
2,2-Dimethyl-2,3-dihydro-1-benzofuran-7-yl N-Methylcarbamate	C11-A032
2,2-Dimethyl-2,3-dihydro-7-benzofuranyl N-Methylcarbamate	C11-A032
2,2-Dimethyl-2,3-dihydrobenzoduranyl-7-N-methylcarbamate	C11-A032
2,2-Dimethyl-2,3-dihydrobenzofuran-7-yl Methylcarbamate	C11-A032
2,2-Dimethyl-3-butanol	C01-C102
2,2-Dimethyl-3-butanone	C01-C101
2,2-Dimethyl-7-benzofuranol, Methylcarbamate	C11-A032
2,2-Dimethyl-7-coumaranyl N-Methylcarbamate	C11-A032
2,2-Dimethylbenzo-1,3-dioxol-4-yl Methylcarbamate	C11-A014
2,2-Dimethylbut-3-yl Methylphosphonofluoridate	C01-A003
2,2-Dimethylbutanone	C01-C101
2,2-Dimethylbuty-3-yl Methyl-d3-phosphonofluoridate	C01-A003
2,2-Dimethylbuty-3-yl-d13 Methylphosphonofluoridate	C01-A003
2,2-Dimethylcyclopentyl Methylphosphonofluoridate	C01-A006
2,2-Dimethyldichlorovinyl Phosphate	C11-A055
2,2-Iminodiethanol	C03-D060
2,3,4,5,6-Pentachloorfenol	C11-A134
2,3,4,5,6-Pentachlorfenol	C11-A134
2,3,4,5,6-Pentachlorophenol	C11-A134
2,3,4,5,6-Pentaclorofenol	C11-A134
2,3,4,5,6-Pentaklorfenol	C11-A134
2,3-Bis(diethoxyphosphinothioylthio)-1,4-dioxane	C11-A061
2,3-Butylene Fluorophosphite	C01-C158
2,3-Butylene Phosphorofluoridite	C01-C158
2,3-Dibromo-1-chloropropane	C11-A053
2,3-Dihydro-2,2-dimethyl benzofuran-7-yl Methylcarbamate	C11-A032
2,3-Dihydro-2,2-dimethyl-7-benzofuranol Methylcarbamate	C11-A032
2,3-Dihydro-2,2-dimethyl-7-benzofuranol N-Methylcarbamate	C11-A032
2,3-Dihydro-2,2-dimethyl-7-benzofuranyl Methylcarbamate	C11-A032
2,3-Dihydro-2,2-dimethyl-7-benzofuranyl Methylcarbamate	C11-A032
2,3-Dihydro-2,2-dimethyl-7-benzofuranyl N-Methylcarbamate	C11-A032
2,3-Dihydro-2,2-dimethylbenzofuran-7-yl Methylcarbamate	C11-A032
2,3-Dihydro-2,2-dimethylbenzofuranyl-7-N-methylcarbamate	C11-A032
2,3-Dihydrothiirene	C03-D047
2,3-Dithiabutane	C01-C062
2,3-Isopropylidene-dioxyphenyl Methylcarbamate	C11-A014
2,3-para-Dioxandithiol S,S-Bis(O,O-diethyl Phosphorodithioate)	C11-A061
2,3-para-Dioxane S,S'-Bis(O,O-diethyl Phosphorodithioate)	C11-A061
2,3-para-Dioxane S,S-Bis(O,O-diethylphosphorodithioate)	C11-A061
2,3-para-Dioxane S,S-Bis(O,O-diethylphosphoroithioate)	C11-A061
2,3-para-Dioxanedithiol S,S-Bis(O,O-diethyl Phosphorodithioate)	C11-A061

2,3-para-Dioxan-S,S'-bis(O,O-diaethyldithiophosphat)	C11-A061
2,3-p-Dioxandithiol S,S-bis(O,O-Diethyl Phosphorodithioate)	C11-A061
2,3-p-Dioxane S,S'-Bis(O,O-diethyl Phosphorodithioate)	C11-A061
2,3-p-Dioxane S,S-Bis(O,O-diethylphosphorodithioate)	C11-A061
2,3-p-Dioxane S,S-Bis(O,O-diethylphosphoroithioate)	C11-A061
2,3-p-Dioxanedithiol S,S-Bis(O,O-diethyl Phosphorodithioate)	C11-A061
2,3-p-Dioxanethiol S,S-Bis(O,O-diethyl Phosphoro-dithioate)	C11-A061
2,3-p-Dioxan-S,S'-bis(O,O-diaethyldithiophosphat)	C11-A061
2,4,6,7,8,10-Hexaoxa-1,3,5,7-tetraarsatricyclo[3.3.1.1]decane	C11-A012
2,4-Dichloro-a-(chloromethylene)benzyl Alcohol Diethyl Phosphate	C11-A037
2,4-Dichloro-alpha-(chloromethylene)benzyl Alcohol Diethyl Phosphate	C11-A037
2,4-Dichloro-alpha-(chloromethylene)benzyl Diethyl Phosphate	C11-A037
2,4-Dichloro-α-(chloromethylene)benzyl Diethyl Phosphate	C11-A037
2,4-Diisocianato-1-metil-benzeno	C11-A173
2,4-Diisocyanato-1-methylbenzene	C11-A173
2,4-Diisocyanatotoluene	C11-A173
2,4-Diisocyanattoluol	C11-A173
2,4-Diisosianato-1-metilbenzena	C11-A173
2,4-Di-isosyanaatto-1-metyylibentseeni	C11-A173
2,4-Diizocyjanianotoluen	C11-A173
2,4-Dwuizocyjanian Toluilenu	C11-A173
2,4-TDI	C11-A173
2,4-Tolueendi-isocyanaat	C11-A173
2,4-Tolueenidi-isosyanaattia	C11-A173
2,4-Toluene Diisocyanate	C11-A173
2,4-Toluylene Diisocyanate	C11-A173
2,4-Tolylene Diisocyanate	C11-A173
2,6,7-Trioxa-1-phosphabicyclo(2.2.2)octan-1-one, 4-(t-Butyl)-	C06-A004
2,6,7-Trioxa-1-phosphabicyclo(2.2.2)octan-1-one, 4-(tert-Butyl)-	C06-A004
2,6,7-Trioxa-1-phosphabicyclo(2.2.2)octan-1-oxide, 4-Isopropyl-	C06-A003
2,6,7-Trioxa-1-phosphabicyclo(2.2.2)octane, 4-(1,1-Dimethylethyl)-, 1-Oxide	C06-A004
2,6,7-Trioxa-1-phosphabicyclo(2.2.2)octane, 4-Ethyl-, 1-Oxide	C06-A002
2,6,7-Trioxa-1-phosphabicyclo(2.2.2)octane, 4-Ethyl-, 1-Sulfide	C06-A005
2,6,7-Trioxa-1-phosphabicyclo(2.2.2)octane, 4-Methyl-, 1-Oxide	C06-A001
2,6,7-Trioxa-1-phosphabicyclo[2.2.2]octane, 4-(Isopropyl)-, 1-Oxide	C06-A003
2,6,7-Trioxa-1-phosphabicyclo[2.2.2]octane, 4-Methyl-, 1-Oxide	C06-A001
2,6-Diisocianato-1-metil-benzeno	C11-A174
2,6-Diisocyanato-1-methylbenzene	C11-A174
2,6-Diisocyanatotoluene	C11-A174
2,6-Diisocyanattoluol	C11-A174
2,6-Diisosianato-1-metilbenzena	C11-A174
2,6-Di-isosyanaatto-1-metyylibentseeni	C11-A174
2,6-Diizocyjanianotoluen	C11-A174
2,6-Dimethyl-3,5-diazahepta-3,4-diene	C01-C058
2,6-Dwuizocyjanian Toluilenu	C11-A174
2,6-TDI	C11-A174
2,6-Tolueendi-isocyanaat	C11-A174
2,6-Tolueenidi-isosyanaattia	C11-A174
2,6-Toluene Diisocyanate	C11-A174

(*Continued*)

2,6-Toluenediisocyanate	C11-A174
2,6-Toluylene Diisocyanate	C11-A174
2,6-Tolylene Diisocyanate	C11-A174
2-[(2-Hydroxyethyl)(methyl)amino]ethanol	C03-C043
2-[(2-Hydroxyethyl)amino]ethan-1-ol	C03-D060
2-[(2-Hydroxyethyl)amino]ethanol	C03-D060
2-[2-(2-Hydroxyethylsulfanyl)ethylsulfanyl]ethanol	C03-D046
2-[2-(2-Hydroxyethylthio)ethylthio]ethan-1-ol	C03-D046
2-[Bis(1-methylethyl)amino]-ethanethiol	C01-C105
2-[Bis(2-hydroxyethyl)amino]ethanol	C03-C045
2-[Bis(propan-2-yl)amino]ethane-1-thiol	C01-C105
2-[Butan-2-ylsulfanyl(ethoxy)phosphoryl]sulfanylbutane	C11-A031
2-[Chloro(methyl)phosphoryl]oxypropane	C01-C054
2-[Di(propan-2-yl)amino]ethanethiol	C01-C105
2-[Di(propan-2-yl)amino]ethanol	C01-C104
2-[Di(propan-2-yl)amino]ethylsulfanyl-methylphosphinic Acid	C01-D177
2-[Ethyl(2-hydroxyethyl)amino]ethan-1-ol	C03-C044
2-[Ethyl(2-hydroxyethyl)amino]ethanol	C03-C044
2-[Fluoro(methyl)phosphoryl]oxy-1,1-dimethylcyclopentane	C01-A006
2-{[Ethoxy(ethyl)phosphoryl]sulfanyl}-N,N,N-triethylethanaminium Iodide	C01-A023
2-{[Ethoxy(ethyl)phosphoryl]sulfanyl}-N,N,N-trimethylethanaminium Iodide	C01-A023
2-{[Ethoxy(methyl)phosphoryl]sulfanyl}-N,N,N-triethylethanaminium Iodide	C01-A015
2-{[Ethoxy(methyl)phosphoryl]sulfanyl}-N,N-diethyl-N-methylethanaminium Iodide	C01-A015
2',1-(Dimethyltriethyl)amine	C03-A033
2',2"-Dichloro-1,1-dimethyltriethylamine	C03-A033
2',2"-Dichloro-1-methyltriethylamine	C03-A029
20Z996230U	C01-C059
26Q0321ZDG	C01-C086
2-Aminoanisole	C11-A010
2-Aminomethoxybenzene	C11-A010
2-Amino-propaan	C01-C100
2-Aminopropan	C01-C100
2-Aminopropane	C01-C100
2-Anisidine	C11-A010
2B10-MM	C01-C099
2-Bromo-N,N-bis(2-bromoethyl)ethanamine	C03-A021
2-Butanamine, N,N-Bis(2-chloroethyl)-	C03-A034
2-Butanol, 3,3-Dimethyl-	C01-C102
2-Butanol, 3,3-Dimethyl-, Methylphosphonochloridate	C01-C055
2-Butanol, 3,3-Dimethyl-, Methylphosphonofluoridate	C01-A003
2-Butanol, 3-Chloro-, Hydrogen Phosphorochloridate O-[(Chlorofluoromethylene)amino] Derivative	C01-C143
2-Butanol, 3-Chloro-, Hydrogen Phosphorofluoridate O-[(Chlorofluoromethylene)amino] Derivative	C01-A051
2-Butanone, 3,3-Dimethyl-	C01-C101
2-Buten-1-al	C11-A047
2-Butenal	C11-A047
2-Butenal, (E)-	C11-A047
2-Butenal, (Z)-	C11-A047
2-Butenaldehyde	C11-A047
2-Butenoic Acid, 3-[(Dimethoxyphosphinyl)oxy]-, Methyl Ester	C11-A123
2-Butyl Chloroformate	C11-A027

2-Carbomethoxy-1-methylvinyl Dimethyl Phosphate	C11-A123
2-Carbomethoxy-1-propen-2-yl Dimethyl Phosphate	C11-A123
2-Chloorethanol	C03-C041
2-Chloraethanol	C03-C041
2-Chloranylethanoyl Chloride	C11-A042
2-Chlorethanol	C03-C041
2-Chloro Acetylchloride	C11-A042
2-Chloro-1-(2,4-Dichlorophenyl)vinyl Diethyl Phosphate	C11-A037
2-Chloro-1-(dimethylamino)ethane	C01-C099
2-Chloro-1,1,2-trifluoroethylene	C11-A177
2-Chloro-1',1"-dimethyltriethylamine	C01-C
2-Chloro-1-ethanal	C11-A040
2-Chloro-1-ethanol	C03-C041
2-Chloro-1-hydroxyethane	C03-C041
2-Chloro-2',2''-difluorotriethylamine	C03-A023
2-Chloroacetaldehyde	C11-A040
2-Chloroacetic Acid Chloride	C11-A042
2-Chloroacetic Chloride	C11-A042
2-Chloroacetonitrile	C11-A041
2-Chloroacetyl Chloride	C11-A042
2-Chloroethanal	C11-A040
2-Chloroethanol	C03-C041
2-Chloroethenylarsinic Oxide	C04-D008
2-Chloroethenylarsonous Dichloride	C04-A002
2-Chloroethyl Alcohol	C03-C041
2-Chloroethyl Chloromethyl Sulfide	C03-A008
2-Chloroethyl Dimethyl Ammonium Chloride	C01-C099
2-Chloroethyl Ether	C11-A017
2-Chloroethyl Methyl 1-Chloroacetamide	C03-A020
2-Chloroethyl Vinyl Sulfide	C03-D054
2-Chloroethyl Vinyl Sulfone	C03-D052
2-Chloroethyl Vinyl Sulfoxide	C03-D053
2-Chloroethyldiisopropylamine Hydrochloride	C01-C
2-Chloroethyldimethylamine Monohydrochloride	C01-C099
2-Chloroethyldimethylammonium Chloride	C01-C099
2-Chloroethyl-N,N-diisopropylamine	C01-C
2-Chloroethyl-N,N-dimethylamine Hydrochloride	C01-C099
2-Chloroethylthio Ethene	C03-D054
2-Chloroethylvinyl Sulfide	C03-D054
2-Chloroethylvinylsulphoxide	C03-D053
2-Chloro-N-(2-chloroethyl)-N-ethylethanamine	C03-A016
2-Chloro-N-(2-chloroethyl)-N-ethylethanaminium Chloride	C03-A016
2-Chloro-N-(2-chloroethyl)-N-methyl-1-propanamine	C03-A025
2-Chloro-N-(2-chloroethyl)-N-methylacetamide	C03-A020
2-Chloro-N-(2-chloroethyl)-N-methylethanamine	C03-A017
2-Chloro-N-(2-chloroethyl)-N-methylethanamine, Hydrochloride	C03-A017
2-Chloro-N-(2-chloroethyl)-N-methylethanaminium Chloride	C03-A017
2-Chloro-N-(2-chloropropyl)-N-methyl 1-Propanamine	C03-A031
2-Chloro-N-(2-chloropropyl)-N-methyl-1-propanamine Hydrochloride	C03-A031

(*Continued*)

2-Chloro-N-(2-chloropropyl)-N-methyl-propan-1-amine	C03-A031
2-Chloro-N,N-bis(2-chloroethyl)ethanamine	C03-A018
2-Chloro-N,N-bis(2-chloroethyl)ethanaminium Chloride	C03-A018
2-Chloro-N,N-bis(2-chloroethyl)ethanammonium Chloride	C03-A018
2-Chloro-N,N-bis(2-fluoroethyl)ethanamine	C03-A023
2-Chloro-N,N-diisopropylethylamine	C01-C
2-Chloro-N,N-dimethylaminoethane	C01-C099
2-Chloro-N,N-dimethylethanamine	C01-C099
2-Chloro-N,N-dimethylethanamine Hydrochloride	C01-C099
2-Chloro-N,N-dimethylethanaminium Chloride	C01-C099
2-Chloro-N,N-dimethylethylamine	C01-C099
2-Chloro-N,N-dimethylethylamine Hydrochloride	C01-C099
2-Chloro-N-[(chloroethoxyphosphinyl)oxy]ethanimidoyl Chloride	C01-C134
2-Chloro-N-[(chloromethoxyphosphinyl)oxy]ethanimidoyl Chloride	C01-C125
2-Chloro-N-[(dichlorophosphinyl)oxy]ethanimidoyl Chloride	C01-C114
2-Chloro-N-[[chloro(2,2,3,3-tetrafluoropropoxy)phosphinyl]oxy]ethanimidoyl Chloride	C01-C142
2-Chloro-N-[chloro(2,2,3,3-tetrafluoropropoxy)phosphoryl]oxy-acetimidoyl Chloride	C01-C142
2-Chloro-N-[chloro(ethoxy)phosphoryl]oxy-acetimidoyl Chloride	C01-C134
2-Chloro-N-[chloro(methoxy)phosphoryl]oxy-acetimidoyl Chloride	C01-C125
2-Chloro-N-dichlorophosphoryloxy-acetimidoyl Chloride	C01-C114
2-Chloropropyl 2-Chloroethyl Methylamine	C03-A025
2-Chlorovinyl Dichloroarsine	C04-A002
2-Chlorovinylarsenic Oxide	C04-D008
2-Chlorovinylarsenious Oxide	C04-D008
2-Chlorovinylarsenous Oxide	C04-D008
2-Chlorovinylarsine Oxide	C04-D008
2-Chlorovinyldichloroarsine	C04-A002
2-Chlorovinylodichloroarsine	C04-A002
2-Chlorvinylarsinether	C04-D008
2-Cloroacetonitrile	C11-A041
2-Cloroetanolo	C03-C041
2-Cyano-1-propene	C11-A101
2-Cyano-2-hydroxypropane	C11-A001
2-Cyano-2-propanol	C11-A001
2-Cyanopropan-2-ol	C11-A001
2-Cyanopropane	C11-A095
2-Cyanopropeen	C11-A101
2-Cyanopropene	C11-A101
2-Dichlorophosphorylpropane	C01-C096
2-Diethoxyphosphorylpropane	C01-C091
2-Diethylaminoethanol	C01-C103
2-Diethylaminoethyl (Diethylamido) Flurophosphonate	C01-A032
2-Diethylaminoethyl (Dimethylamido) Flurophosphonate	C01-A031
2-Diethylaminoethyl Alcohol	C01-C103
2-Diethylaminoethyl N,N-Diethylphosphoramidofluoridate	C01-A032
2-Diethylaminoethyl N,N-Dimethylphosphoramidofluoridate	C01-A031
2-Difluorophosphorylpropane	C01-C068
2-Diisopropylamino Ethanethiol	C01-C105
2-Diisopropylaminoethanol	C01-C104
2-Diisopropylaminoethyl Chloride	C01-C

2-Dimethoxyfosfinoylthio-N-methylaceetamide	C11-A131
2-Dimethoxyphosphinoylthio-N-methylacetamide	C11-A131
2-Dimethoxyphosphorylsulfanyl-N-methylacetamide	C11-A131
2-Dimethyl Cis-2-dimethyl-carbamoyl-1-methylvinyl Phosphate	C11-A056
2-Dimethylamino-1-(methylthio)glyoxal O-Methylcarbamoylmonoxime	C11-A147
2-Dimethylaminoethyl (Diethylamido) Flurophosphonate	C01-A030
2-Dimethylaminoethyl (Dimethylamido) Flurophosphonate	C01-A029
2-Dimethylaminoethyl Chloride Hydrochloride	C01-C099
2-Dimethylaminoethyl N,N-Diethylphosphoramidofluoridate	C01-A030
2-Dimethylaminoethyl N,N-Dimethylphosphoramidofluoridate	C01-A029
2-Dimethylaminoethyl N,N-Dimethylphosphoramidofluoridate Methiodide	C01-A029
2-Dimethylaminoethylsulfanyl(methyl)phosphinic Acid	C01-D178
2-Dimethylaminomethyl-3-hydroxypyridine	C02-C053
2-Dimethylaminomethyl-3-pyridinol	C02-C053
2-Dimethylaminopropyl (Diethylamido) Flurophosphonate	C01-A034
2-Dimethylaminopropyl N,N- Diethylphosphoramidofluoridate	C01-A034
2-Ethyl-2-(hydroxymethyl)-1,3-propanediol Cyclic Phosphate	C06-A002
2-Ethylamine	C11-A068
2-Fluoranylethanamide	C11-A077
2-Fluorethylester Kyseliny Fluoroctove	C11-A080
2-Fluoro-1,3,2-dioksafosfolan	C01-C156
2-Fluoro-1,3,2-dioxaphospholane	C01-C156
2-Fluoro-1,3-dioxa-2-phosphacyclopentane	C01-C156
2-Fluoro-1-ethanol	C11-A079
2-Fluoro-4,5-dimethyl-1,3,2-dioxaphospholane	C01-C158
2-Fluoro-4,5-dimethyl-1,3-dioxa-2-phosphacyclopentane	C01-C158
2-Fluoro-4,5-metylo-1,3,2-dioksafosfolan	C01-C158
2-Fluoro-4-methyl-1,3-dioxa-2-phosphacyclopentane	C01-C157
2-Fluoro-4-metylo-1,3,2-dioksafosfolan	C01-C157
2-Fluoroacetamide	C11-A077
2-Fluoroacétate de Sodium	C11-A152
2-Fluoroacetato di Sodio	C11-A152
2-Fluoroacetic Acid	C11-A078
2-Fluoroacetic Amide	C11-A077
2-Fluoroethane-1-ol	C11-A079
2-Fluoro-ethano	C11-A079
2-Fluoroethanol	C11-A079
2-Fluoroethyl 2-Fluoroacetate	C11-A080
2-Fluoroethyl Fluoroacetate	C11-A080
2-Fluoroethylalcohol	C11-A079
2-Fluoro-N-(2-fluoroethyl)-N-methylethanamine	C03-A019
2-Fluoro-N,N-bis(2-fluoroethyl)ethanamine	C03-A024
2-Fluroro-4-methyl-1,3,2-dioxaphospholane	C01-C157
2-Hydroxy-2-cyanopropane	C11-A001
2-Hydroxy-2-methylpropanenitrile	C11-A001
2-Hydroxy-2-methylpropionitrile	C11-A001
2-Hydroxyethyl Chloride	C03-C041
2-Hydroxyethyl Sulfide	C03-C037
2-Hydroxyisobutyronitrile	C11-A001

(*Continued*)

2-Hydroxytriethylamine	C01-C103
2-Isocyanato-2-methylpropane	C11-A029
2-Isocyanatopropane	C11-A094
2-Isopropoxyfenyl-methylcarbamaat	C11-A143
2-Isopropoxyphenyl Methylcarbamate	C11-A143
2-Mercaptoethanethiol	C03-D048
2-Methallyl Chloride	C11-A102
2-Methoxy-1-aminobenzene	C11-A010
2-Methoxyaniline	C11-A010
2-Methoxybenzenamine	C11-A010
2-Methoxybenzeneamine	C11-A010
2-Methoxycarbonyl-1-methylvinyl Dimethyl Phosphate	C11-A123
2-Methoxycarbonyl-1-methylvinyldimethylfosfaat	C11-A123
2-Methoxyethylmercury Acetate	C11-A108
2-Methoxyethylmerkuriacetat	C11-A108
2-Methoxyethylquecksilberacetat	C11-A108
2-Methoxykarbonyl-1-methylvinyldimethylfosfát	C11-A123
2-Methoxylaniline	C11-A010
2-Methoxyphenylamine	C11-A010
2-Methyl Aziridine	C11-A145
2-Methyl-1,3-phenylene Diisocyanate	C11-A174
2-Methyl-2-(methylthio)propanal O-[(Methylamino)carbonyl]oxime	C11-A003
2-Methyl-2-(methylthio)propionaldehyde O-(Methylcarbamoyl) Oxime	C11-A003
2-Methyl-2-hydroxypropionitrile	C11-A001
2-Methyl-2-propeennitril	C11-A101
2-Methyl-2-propenenitrile	C11-A101
2-Methyl-2-propennitril	C11-A101
2-Methyl-2-propenyl Chloride	C11-A102
2-Methyl-3-chloro-1-propene	C11-A102
2-Methyl-3-chloropropene	C11-A102
2-Methylacrylonitrile	C11-A101
2-Methylallyl Chloride	C11-A102
2-Methylazacyclopropane	C11-A145
2-Methylbenzene-1,3-diisocyanate	C11-A174
2-Methylbiphenyl-3-ylmethyl (1 R)-Cis-3-((Z)-2-chloro-3,3,3-trifluoroprop-1-enyl)-2,2-dimethylcyclopropanecarboxylate	C11-A016
2-Methylbiphenyl-3-ylmethyl (Z)-(1RS,3RS)-3-(2-chloro-3,3,3-trifluoroprop-1-enyl)-2,2-dimethylcyclopropanecarboxylate	C11-A016
2-Methylbiphenyl-3-ylmethyl-(Z)-(1RS)-cis-3-(2-chloro-3,3,3-trifluoroprop-1-enyl)-2,2-dimethylcyclopropanecarboxylate	C11-A016
2-Methylcyclohexyl Methylphosphonofluoridate	C01-A008
2-Methylcyclohexyl Methylphosphonofluoridoate	C01-A008
2-Methylethylenimine	C11-A145
2-Methylhydrazine	C11-A116
2-Methyllactonitrile	C11-A001
2-Methyl-meta-phenylene Diisocyanate	C11-A174
2-Methyl-meta-phenylene Isocyanate	C11-A174
2-Methyl-m-phenylene Diisocyanate	C11-A174
2-Methyl-m-phenylene Isocyanate	C11-A174
2-Methyl-N,N-dipropyl-propanamidine {Novichok Precursor}	C01-C

2-Methyloxyaniline	C11-A010
2-methylprop-2-enenitrile	C11-A101
2-Methylpropan-2-isocyanate	C11-A029
2-Methylpropane Nitrile	C11-A095
2-Methylpropenenitrile	C11-A101
2-Methylpropionitrile	C11-A095
2-Methylpropoxycarbonyl Chloride	C11-A092
2-Methylpropyl Carbonochloridate	C11-A092
2-Methylpropyl Chlorocarbonate	C11-A092
2-Methylpropyl Chloroformate	C11-A092
2-Methylpropyl S-2-Diethylaminoethyl Methylphosphonothiolate	C01-A016
2-Methylpropyloxycarbonylchloride	C11-A092
2-Methylthio-acetaldehyd-O-(methylcarbamoyl)-oxime	C11-A107
2-Methylthiopropionaldehyd-O-(methylcarbamoyl)oxim	C11-A107
2-Metil-2-tiometil-propionaldeid-O-(N-metil-carbamoil)-ossima	C11-A003
2-Metoxicarbonil-1-metilvinil Dimetil Fosfato	C11-A123
2-Metyyliprop-2-eeninitriili	C11-A101
2-Monochloroethanol	C03-C041
2-N-(Diethylamino)ethanol	C01-C103
2-N,N-Diisopropylaminoethanol	C01-C104
2-N,N-Diisopropylaminoethyl Chloride	C01-C
2-N,N-Dimethylaminoethyl Chloride	C01-C099
2-N,N-Dimethylaminoethyl Chloride Hydrochloride	C01-C099
2O9AXL1TJ4	C11-A045
2-Oxetanone, 4-Methylene	C11-A057
2-Pentenedioic Acid, 3-[(Dimethoxyphosphinyl)oxy]-, Dimethyl Ester	C11-A018
2-Propanamine	C01-C100
2-Propanamine, N-(1-Methylethyl)-	C01-D174
2-Propanamine, N-(2-Chloroethyl)-N-(1-methylethyl)-	C01-C
2-Propanamine, N,N'-(Dithiodi-2,1-ethanediyl)bis[N-(1-methylethyl)-	C01-D167
2-Propanamine, N,N'-(Thiodi-2,1-ethanediyl)bis[N-(1-methylethyl)-	C01-D166
2-Propanamine, N,N'-Methanetetraylbis-	C01-C058
2-Propanamine, N,N-Bis(2-chloroethyl)-	C03-A029
2-Propanamine, N,N-Bis(2-chloroethyl)-2-methyl-	C03-A033
2-Propanamine, N-Bis(2-chloroethyl)-2-methyl-	C03-A033
2-Propanamine, N-Chloro-	C01-D172
2-Propanamine, N-Ethyl-N-(1-methylethyl)-	C01-D176
2-Propanaminium, N-[2-[(Ethoxymethylphosphinyl)thio]ethyl]-N-methyl-N-(1-methylethyl)-, Iodide	C01-A017
2-Propanephosphonyl Chloride	C01-C096
2-Propanol, 1-Chloro-, Hydrogen Phosphorofluoridate O-[(Chlorofluoromethylene)amino] Derivative	C01-A050
2-Propanone, 1,1,1,3,3,3-Hexafluoro-	C11-A086
2-Propanone, Cyanohydrin	C11-A001
2-Propanone, Hexafluoro-	C11-A086
2-Propen-1-amine	C11-A005
2-Propen-1-amine, N,N-Bis(2-chloroethyl)-	C03-A027
2-Propenamine	C11-A005
2-Propene-1-ol	C11-A004
2-Propenenitrile	C11-A002
2-Propenenitrile	C11-A041

(*Continued*)

2-Propenenitrile, 2-Methyl	C11-A101
2-Propenol	C11-A004
2-Propenyl Alcohol	C11-A004
2-Propenyl Chloroformate	C11-A006
2-Propenyl Isothiocyanate	C11-A007
2-Propenylamine	C11-A005
2-Propyl Chloroformate	C11-A093
2-Propyl Isocyanate	C11-A094
2-Propyl Methylphosphonochloridate	C01-C054
2-Propylamine	C01-C100
2-Propylcyanide	C11-A095
2-Propynenitrile, Hydrocyanide	C07-A001
3-((Dimethoxyphosphinyl)oxy)-2-butenoic Acid Methyl Ester	C11-A123
3-(2,2-Dibromoethenyl)-2,2-dimethylcyclopropanecarboxylic Acid Cyano(3-phenoxyphenyl)methyl Ester	C11-A049
3-(Dimethoxyphosphinothioylsulfanylmethyl)-1,2,3-benzotriazin-4-one	C11-A013
3-(Dimethoxyphosphinothioylsulfanylmethyl)-5-methoxy-1,3,4-thiadiazol-2-one	C11-A105
3-(Dimethoxyphosphinyloxy)-N,N-dimethyl-cis-crotonamide	C11-A056
3-(Dimethoxyphosphinyloxy)-N-methyl-cis-crotonamide	C11-A125
3-(Dimethylamino)-1-methyl-3-oxo-1-propenyl Dimethyl Phosphate (E)-isomer	C11-A056
3-(Dimethylaminomethyl)pyridine	C02-C053
3-(Mercaptomethyl)-1,2,3-benzotriazin-4(3 H)-one O,O-Dimethyl Phosphorodithioate	C11-A013
3-(Mercaptomethyl)-1,2,3-benzotriazin-4(3 H)-one O,O-Dimethyl Phosphorodithioate S-Ester	C11-A013
3,3-Dimethyl-2-butanol	C01-C102
3,3-Dimethyl-2-butanone	C01-C101
3,3-Dimethyl-2-butyl Methylphosphonofluridate	C01-A003
3,3-Dimethylbutan-2-one	C01-C101
3,3-Dimethylbutane-2-ol	C01-C102
3,3-Dimethylbutanone	C01-C101
3,3-Dimethyl-n-but-2-yl Methylphosphonofluoridate	C01-A003
3,5-Dimethyl-4-(methylsulfanyl)fenyl-N-methylkarbamát	C11-A106
3,5-Dimethyl-4-(methylsulfanyl)phenyl Methylcarbamate	C11-A106
3,5-Dimethyl-4-(methylsulfanyl)phenyl N-Methylcarbamate	C11-A106
3,5-Dimethyl-4-(methylthio)phenol Methylcarbamate	C11-A106
3,5-Dimethyl-4-methylmercaptophenyl-N-methylcarbamat	C11-A106
3,5-Dimethyl-4-methylthiophenyl N-Methylcarbamate	C11-A106
3,5-Dimethyl-4-methyl-thiophenyl-N-carbamat	C11-A106
3,5-Xylenol, 4-(Methylthio)-, Methylcarbamate	C11-A106
3,6-Dithia-1,8-octanedichloride	C03-A002
3,6-Dithia-1,8-octanediol	C03-D046
3,6-Dithiaoctane-1,8-diol	C03-D046
3-[(Dimethoxyphosphinothioylthio)methyl]-5-methoxy-1,3,4-thiadiazol-2-one	C11-A105
3-[(Dimethylcarbamoyl)oxy]-N,N-diethyl-N-methylanilinium Iodide	C02-A050
3-[Chloro(methyl)phosphoryl]oxy-2,2-dimethylbutane	C01-C055
3-Amino-1-propene	C11-A005
3-Aminopropene	C11-A005
3-Aminopropylene	C11-A005
3beta-(2-Chloro-3,3,3-trifluoro-1-propenyl)-2,2-dimethylcyclopropane-1beta-carboxylic Acid (2-Methylbiphenyl-3-yl)methyl Ester	C11-A016
3-Butenoic Acid, 3-Hydroxy-, beta-Lactone	C11-A057

3-Butenoic Acid, 3-Hydroxy-, β-Lactone	C11-A057
3-Chlor-2-methyl-1-propen	C11-A102
3-Chlor-2-methyl-prop-1-en	C11-A102
3-Chlor-2-methylpropen	C11-A102
3-Chlorisobuten	C11-A102
3-Chloro-1,2-dibromopropane	C11-A053
3-Chloro-2-methyl Propene	C11-A102
3-Chloro-2-methyl-1-propene	C11-A102
3-Chloro-2-methylprop-1-ene	C11-A102
3-Chloro-2-methyl-prop-1-ene	C11-A102
3-Chloro-2-methylpropene	C11-A102
3-Chloro-2-methylpropene-1	C11-A102
3-Chloroisobutene	C11-A102
3-Chloroisobutylene	C11-A102
3-Chloro-N-(2-chloroethyl)-N-methylpropylamine	C03-A026
3-Chloro-N,N-bis(2-chloroethyl)-1-propanamine	C03-A028
3-Chloro-N,N-bis(2-chloroethyl)propylamine	C03-A028
3-Chloropropyl 2-Chloroethyl Methylamine	C03-A026
3-Chloropropylene Bromide	C11-A053
3-Cloro-2-metil-1-propeno	C11-A102
3-Cloro-2-metil-prop-1-ene	C11-A102
3-Cloro-2-metilpropeno	C11-A102
3-Cloroisobutileno	C11-A102
3-Dimethoxyphosphinoyloxy-N,N-dimethylisocrotonamide	C11-A056
3-Dimethoxyphosphinyloxy-N,N-dimethylisocrotonamide	C11-A056
3-Dimethoxyphosphoryloxy-N-methylbut-2-enamid	C11-A125
3-Dimethylaminopropyl N,N-Dimethylphosphoramidofluoridate	C01-A033
3-Ethyl-3-azapentane-1,5-diol	C03-C044
3-Hydroxy-1-propene	C11-A004
3-Hydroxy-2-pentenedioic Acid Dimethyl Ester Dimethyl Phosphate	C11-A018
3-Hydroxycrotonic Acid Methyl Ester Dimethyl Phosphate	C11-A123
3-Hydroxydimethyl Crotonamide Dimethyl Phosphate	C11-A056
3-Hydroxyglutaconate Dimethyl Phosphate	C11-A018
3-Hydroxyglutaconic Acid Dimethyl Ester Dimethyl Phosphate	C11-A018
3-Hydroxy-N,N-dimethyl-cis-crotonamide Dimethyl Phosphate	C11-A056
3-Hydroxy-N-methyl-cis-crotonamide Dimethyl Phosphate	C11-A125
3-Hydroxy-N-methyl-cis-crotonamide Dimethyl Phosphate Ester	C11-A125
3-Hydroxy-N-methylcrotonamide Dimethylphosphate	C11-A125
3-Hydroxypropene	C11-A004
3-Isothiocyanato-1-propene	C11-A007
3-Isothiocyanatoprop-1-ene	C11-A007
3-Isothiocyanatopropene	C11-A007
3-Pyridinol, 2-[(Dimethylamino)methyl]-	C02-C053
3-Quinuclidyl N,N-Dimethylphosphoramidofluoridate	C01-A035
3-Thia-1,4-pentadiene	C03-D051
3-Thiabutan-2-one, O-(Methylcarbamoyl)oxime	C11-A107
3-Thiapentane-1,5-diol	C03-C037
3β-(2-Chloro-3,3,3-trifluoro-1-propenyl)-2,2-dimethylcyclopropane-1β-carboxylic Acid (2-Methylbiphenyl-3-yl)methyl Ester	C11-A016

(*Continued*)

4-(1-Methylethyl)-2,6,7-trioxa-1-phosphabicyclo(2.2.2)octane-1-oxide	C06-A003
4-(1-Methylethyl)bicyclophosphate	C06-A003
4-(t-Butyl)-2,6,7-trioxa-1-phosphabicyclo(2.2.2)octan-1-one	C06-A004
4-(tert-Butyl)-2,6,7-trioxa-1-phosphabicyclo(2.2.2)octan-1-one	C06-A004
4,4´-Metilenbis(fenil isocianato)	C11-A113
4,4'-Bipyridinium, 1,1'-dimethyl-, Dichloride	C11-A132
4,4'-Bis(isocyanatophenyl)methane	C11-A113
4,4'-Diisocyanate de Diphenylmethane	C11-A113
4,4'-Diisocyanate de Diphénylméthylène	C11-A113
4,4'-Diisocyanatodiphenylmethane	C11-A113
4,4'-Dimethyldipyridyl Dichloride	C11-A132
4,4'-Diphenylmethane Diisocyanate	C11-A113
4,4'-MDI	C11-A113
4,4'-Methylene Diphenyl Diisocyanate	C11-A113
4,4'-Methylenebis(isocyanatobenzene)	C11-A113
4,4'-Methylenebis(phenyl Isocyanate)	C11-A113
4,4'-Methylenedi-para-phenylene Diisocyanate	C11-A113
4,4'-Methylenediphenyl Diisocyanate	C11-A113
4,4'-Methylenediphenyl Isocyanate	C11-A113
4,4'-Methylenediphenylene Diisocyanate	C11-A113
4,4'-Methylenediphenylene Isocyanate	C11-A113
4,4'-Methylenedi-p-phenylene Diisocyanate	C11-A113
4,4'-Diphenylmethan-diisocyanat	C11-A113
4,6-Methano-6H,14H-indolo[3,2,1-ij]oxepino[2,3,4-de]pyrrolo[2,3-h]quinoline	C11-A159
4-[(4-Isocyanatophenyl)methyl]benzenisocyanate	C11-A113
4-4' Metilena Difenil Diisosianida	C11-A113
4-4'-Methyleendifenyldi-isocyanaat	C11-A113
4-Aethyl-1-phospha-2,6,7-trioxabicyclo(2.2.2)octan-1-oxid	C06-A002
4-Amino Pyridine	C11-A008
4-Aminopyridine	C11-A008
4AP	C11-A008
4APY	C11-A008
4-Cyclohexylamine	C11-A048
4-Ethyl-1-sulfanylidene-2,6,7-trioxa-1λ5-phosphabicyclo[2.2.2]octane	C06-A005
4-Ethyl-2,6,7-trioxa-1-phospha(V)bicyclo[2.2.2]octan-1-one	C06-A002
4-Ethyl-2,6,7-trioxa-1-phosphabicyclo(2.2.2)octane 1-Oxide	C06-A002
4-Ethyl-2,6,7-trioxa-1-phosphabicyclo(2.2.2)octane-1-sulfide	C06-A005
4-Ethyl-2,6,7-trioxa-1-phosphabicyclo[2.2.2]octan-1-one	C06-A002
4-Ethyl-2,6,7-trioxa-1-phosphabicy-clo[2.2.2]octane 1-Oxide	C06-A002
4-Ethylbicyclophosphate	C06-A002
4-Imino-1,4-dihydropyridine	C11-A008
4-Isopropyl-1-phospha-2,6,7-trioxabicyclo(2,2,2)octane 1-Oxide	C06-A003
4-Isopropyl-1-phospha-2,6,7-trioxabicyclo(2.2.2)octane 1-Oxide	C06-A001
4-Isopropyl-2,6,7-trioxa-1-fosfabicyklo(2.2.2)oktan-1-oxid	C06-A003
4-Isopropyl-2,6,7-trioxa-1-phosphabicyclo[2.2.2]octane 1-Oxide	C06-A003
4-Isopropylbicyclophosphate	C06-A003
4-Methyl-1,3-phenylene Diisocyanate	C11-A173
4-Methyl-1-oxo-1-phospha-2,6,7-trioxabicyclo(2.2.2)octane	C06-A001
4-Methyl-2,6,7-trioxa-1-fosfabicyklo(2.2.2)oktan-1-oxid	C06-A001
4-Methyl-2,6,7-trioxa-1lambda5-phosphabicyclo[2.2.2]octan-1-on	C06-A001

4-Methyl-2,6,7-trioxa-1-phospha(V)bicyclo[2.2.2]octan-1-one	C06-A001
4-Methyl-2,6,7-trioxa-1-phosphabicyclo(2.2.2)octane-1-oxide	C06-A001
4-Methyl-2,6,7-trioxa-1-phosphabicyclo[2,2,2]octane-1-oxide	C06-A001
4-Methyl-2,6,7-trioxa-1-phosphabicyclo[2.2.2]octan-1-one	C06-A001
4-Methyl-2,6,7-trioxa-1-phosphabicyclo[2.2.2]octane 1-Oxide	C06-A001
4-Methyl-2,6,7-trioxa-1λ5-phosphabicyclo[2.2.2]octane 1-Oxide	C06-A001
4-Methylbenzene-1,3-diisocyanate	C11-A173
4-Methylbicyclophosphate	C06-A001
4-Methylen-2-oxetanon	C11-A057
4-Methylene-2-oxetanone	C11-A057
4-Methyleneoxetan-2-one	C11-A057
4-Methylideenoxetan-2-on	C11-A057
4-Méthylidèneoxétan-2-one	C11-A057
4-Methylidenoxetan-2-on	C11-A057
4-Methylmercapto-3,5-dimethylphenyl N-Methylcarbamate	C11-A106
4-Methylmercapto-3,5-xylyl Methylcarbamate	C11-A106
4-Methyl-meta-phenylene Diisocyanate	C11-A173
4-Methyl-meta-phenylene Isocyanate	C11-A173
4-Methylthio-3,5-dimethylphenyl Methylcarbamate	C11-A106
4-Methylthio-3,5-dimethylphenyl N-Methylcarbamate	C11-A106
4-Methylthio-3,5-xylyl Methylcarbamate	C11-A106
4-Propan-2-yl-2,6,7-trioxa-1λ5-phosphabicyclo[2.2.2]octane 1-oxide	C06-A003
4-Pyridinamine	C11-A008
4-Pyridinylamine	C11-A008
4-Pyridylamine	C11-A008
4-Pyrimidinol, 2-Isopropyl-6-methyl-, O-Ester with O,O-Diethyl Phosphorothioate	C11-A051
4-t-Butyl Bicyclophosphate	C06-A004
4-t-Butyl-1-oxo-1-phospha-2,6,7-trioxabicyclo(2.2.2)octane	C06-A004
4-t-Butyl-2,6,7-trioxa-1lambda5-phosphabicyclo[2.2.2]octan-1-one	C06-A004
4-t-Butyl-2,6,7-trioxa-1-phosphabicyclo[2.2.2]octane 1-Oxide	C06-A004
4-t-Butyl-2,6,7-trioxa-1λ5-phosphabicyclo[2.2.2]octane 1-Oxide	C06-A004
4-tert-Butyl Bicyclophosphate	C06-A004
4-tert-Butyl-1-oxo-1-phospha-2,6,7-trioxabicyclo(2.2.2)octane	C06-A004
4-tert-Butyl-2,6,7-trioxa-1lambda5-phosphabicyclo[2.2.2]octan-1-one	C06-A004
4-tert-Butyl-2,6,7-trioxa-1-phosphabicyclo[2.2.2]octane 1-Oxide	C06-A004
4-tert-Butyl-2,6,7-trioxa-1λ5-phosphabicyclo[2.2.2]octane 1-oxide	C06-A004
4-Метилен-2-оксетан-2-он	C11-A057
5-Methyl N-(Methylcarbamoyloxy)thioacetimidate	C11-A107
5-Norbornene-2,3-dimethanol, 1,4,5,6,7,7-Hexachloro-, Cyclic Sulfite	C11-A063
5TUN36LARA	C01-C069
6,7,8,9,10,10-Hexachloro-1,5,5a,6,9,9a-hexahydro-6,9-methano-2,3,4-benzodioxathiepin-3-oxide	C11-A063
6,7,8,9,10,10-Hexachloro-1,5,5a,6,9,9a-hexahydro-6,9-methano-2,4,3-benzo[e]-dioxathiepin-3-oxide	C11-A063
6,7,8,9,10,10-Hexachloro-1,5,5a,6,9,9a-hexahydro-6,9-methano-2,4,3-benzodioxathiepin 3-Oxide	C11-A063
6,9-Methano-2,4,3-benzodioxathiepin, 6,7,8,9,10,10-Hexachloro-1,5,5a,6,9,9a-hexahydro-, 3-Oxide	C11-A063
6,9-Methano-2,4,3-benzodioxathiepin, 6,7,8,9,10,10-Hexachloro-1,5,5a,6,9,9a-hexahydro-, 3-Oxide, (3α,5aα,6β,9β,9aα)-	C11-A063
6,9-Methano-2,4,3-benzodioxathiepin, 6,7,8,9,10,10-Hexachloro-1,5,5a,6,9,9a-hexahydro-, 3-Oxide, (3α,5aβ,6α,9α,9aβ)-	C11-A063

(*Continued*)

6,9-Methano-2,4,3-benzodioxathiepin, 6,7,8,9,10,10-Hexachloro-1,5,5a,6,9,9a-hexahydro-, 3-oxide, α-Isomer (3α,5a β,6α,9α,9a β)-	C11-A063
6,9-Methano-2,4,3-benzodioxathiepin, 6,7,8,9,10,10-Hexachloro-1,5,5a,6,9,9a-hexahydro-, 3-Oxide, β-Isomer (3α,5a α,6β,9β,9a α)-	C11-A063
6,9-Methano-2,4,3-benzodioxathiepin, 6,7,8,9,10,10-Hexahydro-	C11-A063
6FK	C11-A086
7-Benzofurano, 2,3-dihydro-2,2-dimethyl, Methylcarbamate	C11-A032
7-Benzofuranol, 2,3-Dihydro-2,2-dimethyl-, 7-(N-Methylcarbamate)	C11-A032
7-Benzofuranol, 2,3-Dihydro-2,2-dimethyl-, Methylcarbamate	C11-A032
12-Molybdophosphoric Acid Hydrate	C11-A124
33SN	C01-A018
47R	C01-C107
58 12 315	C11-A143
1080	C11-A152
1081	C11-A077
1120	C10-A016
6790AF	C07-C007
8375-EP2277867A2	C01-C058
99932760	C11-A072
- A -	
(Acetato)phenyl Mercury	C11-A137
(Acetato-kappaO)(2-methoxyethyl)mercury	C11-A108
(Acetato-O)(2-methoxyethyl)mercury	C11-A108
(Acetato-κO)(2-methoxyethyl)mercury	C11-A108
(Aceto)phenylmercury	C11-A137
(Acetoxymercuri)benzene	C11-A137
[Amino(methylsulfanyl)phosphoryl]oxymethane	C11-A103
A1	C07-A001
A2	C07-A003
A4	C01-A017
A5	C07-A001
A208	C01-A016
A230	C01-A036
A232	C01-A037
A234	C01-A038
A235	C01-A002
A242	C01-A039
A255	C01-A003
A262	C01-A040
AA	C11-A004
Aaalcool Allilco	C11-A004
Aadibroom	C11-A069
AAT	C11-A133
AATP	C11-A133
AB0007248	C01-C058
AB2450000	C11-A040
Abavit B	C11-A096
AC	C07-A001
AC1L45CO	C01-C072
Acarithion	C11-A036

Acephate-met	C11-A103
Acetaldehyde, 2-Chloro-	C11-A040
Acetaldehyde, Chloro-	C11-A040
Acetamide, 2-Chloro-N-(2-chloroethyl)-N-methyl-	C03-A020
Acetamide, 2-Fluoro-	C11-A077
Acetamide, 2-Mercapto-N-methyl-, S-Ester with O,O-Dimethyl Phosphorothioate	C11-A131
Acetate de Phenylmercure	C11-A137
Acetate Phenylmercurique	C11-A137
Acetato(2-methoxyethyl)mercury	C11-A108
Acetato) Trimetaarsenitodicopper	C11-A046
Acetatophenylmercury	C11-A137
Acetic Acid, 2-Fluoro-	C11-A078
Acetic Acid, Fluoro-	C11-A078
Acetic Acid, Fluoro-, 2-Fluoroethyl Ester	C11-A080
Acetic Acid, Fluoro-, Methyl Ester	C11-A114
Acetic Acid, Fluoro-, Sodium Salt	C11-A152
Acetilentetrabromid	C11-A164
Acetimidic Acid, N-[(Methylcarbamoyl)oxy]thio-, Methyl Ester	C11-A107
Acetimidic Acid, Thio-N-((methylcarbamoyl)oxy)-, Methyl Ester	C11-A107
Acetimidothioic Acid, Methyl-, N-(Methylcarbamoyl) Ester	C11-A107
Acetoarsenite de Cuivre	C11-A046
Acetohydroximoyl Fluoride, 2,2-Difluoro-2-nitro-, Ethyl Phosphorofluoridate	C01-A048
Acetohydroximoyl Fluoride, 2,2-Difluoro-2-nitro-, Ethyl Phosphorochloridate	C01-C127
Acetohydroximoyl Fluoride, 2,2-Difluoro-2-nitro-, Methyl Phosphorofluoridate	C01-A044
Acetohydroximoyl Fluoride, 2,2-Difluoro-2-nitro-, Methyl Phosphorochloridate	C01-C120
Acetohydroximoyl Fluoride, 2,2-Difluoro-2-nitro-, Phosphorodichloridate	C01-C113
Acetoncianhidrinei	C11-A001
Acetoncianidrina	C11-A001
Acetoncyaanhydrine	C11-A001
Acetoncyanhydrin	C11-A001
Acetone Cyanhydrin	C11-A001
Acetone Cyanohydrin	C11-A001
Acetone Hexafluoride	C11-A086
Acetone, Hexafluoro-	C11-A086
Acetonecyanhydrine	C11-A001
Acetonitrile, 2-Chloro-	C11-A041
Acetonitrile, Chloro-	C11-A041
Acetonkyanhydrin	C11-A001
Acetosal	C11-A165
Acetosol	C11-A165
Acetoxy(2-methoxyethyl)mercury	C11-A108
Acetoxyphenylmercury	C11-A137
Acety Ketene	C11-A057
Acetyl Chloride, 2,2,2-Trichloro-	C11-A175
Acetyl Chloride, 2,2,2-Trifluoro-	C11-A176
Acetyl Chloride, 2-Chloro-	C11-A042
Acetyl Chloride, Chloro-	C11-A042
Acetyl Chloride, Trichloro-	C11-A175
Acetyl Chloride, Trifluoro-	C11-A176

(*Continued*)

Acetyl Ketene	C11-A057
Acetyleentetrachloride	C11-A165
Acetylene Tetrabomide	C11-A164
Acetylene Tetrabromide	C11-A164
Acetylene Tetrachloride	C11-A165
Acetylentetrachlorid	C11-A165
Acetylentetraklorid	C11-A165
Acetyloxy(2-methoxyethyl)mercury	C11-A108
Acetyloxy(phenyl)mercury	C11-A137
ACF	C11-A006
a-Chloroacetyl Chloride	C11-A042
Acid Ammonium Fluoride	C01-C080
Acid Diclorosulfonic	C11-A158
Acide Chlorhydrique	C11-A088
Acide Cyanhydrique	C07-A001
Acide Fluoborique	C11-A169
Acide Fluoroacétique	C11-A078
Acide Fluoroborique	C11-A169
Acide Monofluoroacétique	C11-A078
Acide Nitrique	C11-A126
Acide Nitrique Fumant Rouge	C11-A126
Acide Perchlorique	C11-A135
Acide Sulfhydrique	C07-A006
Acide Sulfurique	C11-A157
Acide Sulphhydrique	C07-A006
Acide Tétrafluoroborique	C11-A169
Acide-Monofluoracetique	C11-A078
Acido Borofluorico	C11-A169
Acido Cianidrico	C07-A001
Acido Clorhidrico	C11-A088
Acido Cloridrico	C11-A088
Ácido Fluobórico	C11-A169
Acido Fluoroacetico	C11-A078
Acido Fluoroborico	C11-A169
Acido Idrofluoroborico	C11-A169
Acido Monofluoracetio	C11-A078
Acido Monofluoroacetico	C11-A078
Acido Monofluoroacetio	C11-A078
Acido Nitrico	C11-A126
Acido Nitrico Fumante Rosso	C11-A126
Ácido Nítrico Fumegante Vermelho	C11-A126
Acido Osmico	C11-A146
Acido Perclorico	C11-A135
Ácido Selenhídrico	C11-A091
Acido Solforico	C11-A157
Acido Solforico Fumante	C11-A157
Acido Sulfurico	C11-A157
Ácido Sulfúrico Fumante	C11-A157
Acido Tetrafluoroborico	C11-A169
Acido Tetraossoclorico (VII)	C11-A135

Acidomonofluoracetio	C11-A078
Acidomonofluoroacetio	C11-A078
Acidum Sulfuricum Anhydricum	C11-A156
ACMC-209o74	C01-C058
Acquinite	C10-A006
Acrylnitril	C11-A002
Acrylnitrile	C11-A002
Acrylon	C11-A002
Acrylonitrile	C11-A002
Acrylsaeurenitril	C11-A002
ACT10052	C01-C058
Acutox	C11-A134
Adifur	C11-A032
Advacide PMA 18	C11-A137
a-Endosulfan-α	C11-A063
Aethylamine	C11-A068
Aethyl-chlorosulfat	C10-A010
Aethyl-chlorsulfonat	C10-A010
Aethyl-difluorophosphat	C01-C160
Aethylenbromid	C11-A069
Aethylenchlorid	C11-A070
Aethylendichlorid	C11-A070
a-Ethylene Dimercaptan	C03-D048
Aethylenechlorhydrin	C03-C041
Aethylenimin	C11-A072
Aethylenoxid	C11-A071
Aethylensulfid	C03-D047
AFL 1081	C11-A077
Agrimet	C11-A138
Agrisil	C11-A075
Agri-Sul	C01-C061
Agritox	C11-A075
Agrosan	C11-A137
Agrosol	C11-A119
AH 501	C11-A132
AH5950000	C11-A078
AH9100000	C11-A152
AI3-01501	C01-C106
AI3-08584	C11-A010
AI3-08678	C01-C059
AI3-15419	C01-C075
AI3-15638-X	C01-C098
AI3-24207	C11-A043
AI3-28749	C07-C008
AI3-31100-X	C07-A001
AI3-52118	C03-A009
AI3-60394	C01-C086
Aimocron	C11-A125
AITC	C11-A007

(*Continued*)

AITK	C11-A007
AK {Hydrogen Cyanide (80%) and Ethyl Iodoacetate (15%) Mixture}	C07-A
AK20	C11-A126
AK20F	C11-A126
AK20I	C11-A126
AK20K	C11-A126
AK27I	C11-A126
AK27P	C11-A126
Akarithion	C11-A036
AKOS000121276	C01-C058
AKOS000269020	C11-A045
AKOS008968726	C01-C107
AKOS015913384	C01-C059
Akrylonitril	C11-A002
Akrylonitryl	C11-A002
AL8225000	C11-A041
Alatox	C11-A055
Alcide	C11-A038
Alcide Allay	C11-A038
Alcohol of Sulfur	C11-A033
Alcool Allilco	C11-A004
Alcool Allylique	C11-A004
Alcool Tiometilico	C11-A118
Aldacide	C11-A083
Aldecarb	C11-A003
Aldehído Fórmico	C11-A083
Aldehyd Mravenci	C11-A083
Aldehyde Crotonique	C11-A047
Aldehyde Formique	C11-A083
Aldeide Formica	C11-A083
Aldicarb	C11-A003
Alfa-tox	C11-A051
Algard	C11-A055
Algimycin	C11-A137
Algofrene Type 1	C11-A081
Aliylchloroformate	C11-A006
Alkano	C03-C045
Alkron	C11-A133
Alleron	C11-A133
Allilowy Alkohol	C11-A004
Alloc-Cl	C11-A006
Allyl Al	C11-A004
Allyl Alcohol	C11-A004
Allyl Amine	C11-A005
Allyl Carbonochloridate	C11-A006
Allyl Chlorformate	C11-A006
Allyl Chloridocarbonate	C11-A006
Allyl Chlorocarbonate	C11-A006
Allyl Chloroformate	C11-A006
Allyl Isorhodanide	C11-A007

Allyl Isosulfocyanate	C11-A007
Allyl Isosulphocyanate	C11-A007
Allyl Isothiocyanate	C11-A007
Allyl Mustard Oil	C11-A007
Allyl Sevenolum	C11-A007
Allyl Thiocarbonimide	C11-A007
Allyl Thioisocyanate	C11-A007
Allylalkohol	C11-A004
Allylester Kyseliny Chlormravenci	C11-A006
Allylic Alcohol	C11-A004
Allylisothiocyanate	C11-A007
Allylisothiokyanat	C11-A007
Allyloxycarbonyl Chloride	C11-A006
Allylsenevol	C11-A007
Allylsenfoel	C11-A007
Allylsevenolum	C11-A007
Allyspol	C11-A007
Alpha Sulfur	C01-C061
alpha,alpha'-Dichlorodimethyl Ether	C10-A011
alpha,alpha-Dichlorodimethyl Ether	C11-A044
alpha,BET	C11-A070
alpha,beta-Dibromoethane	C11-A069
alpha,beta-Dichloroethane	C11-A070
alpha,beta-Oxidoethane	C11-A071
alpha,omega-Dibromoethane	C11-A069
alpha,omega-Dichloroethane	C11-A070
alpha-Benzoepin	C11-A063
alpha-Chloroacetaldehyde	C11-A040
alpha-Chloroacetonitrile	C11-A041
alpha-Chloroacetyl Chloride	C11-A042
alpha-Cyano-3-phenoxybenzyl (1R-(1alpha(S*),3alpha))-3-(2,2-Dibromovinyl)-2,2-dimethylcyclopropanecarboxylate	C11-A049
alpha-Endosulfan	C11-A063
alpha-Ethylene Dimercaptan	C03-D048
alpha-Fluoroacetamide	C11-A077
alpha-Fluoroacetic Acid	C11-A078
alpha-Hydroxyisobutyronitrile	C11-A001
alpha-Lewisit	C04-A002
alpha-Methacrylonitrile	C11-A101
alpha-Methylacrylonitrile	C11-A101
alpha-Methylpropanenitrile	C11-A095
alpha-Thiodan	C11-A063
alpha-Thionex	C11-A063
AL-PHOS {Aluminum Phosphide}	C11-A139
Alumanylidynearsane	C08-C002
Aluminium Arsenide	C08-C002
Aluminum Arsenide	C08-C002
Aluminum Magnesium Phosphide	C11-A139
Aluminum Monophosphide	C11-A139

(*Continued*)

Aluminum Phosphide	C11-A139
AM83823	C01-C058
Ameisenaldehyd	C11-A083
Ameisensäurealdehyd	C11-A083
Ameisensäuremethylester	C11-A115
American Cyanamid 3422	C11-A133
American Cyanamid 3911	C11-A138
Am-Fol	C11-A009
Amgard V 490	C01-C090
Amid Kyseliny Fluoroctove	C11-A077
Amidogen, Oxo-	C11-A127
Amidor	C11-A103
Amine, Triethyl, 2,2',2"-trihydroxy-	C03-C045
Amino-4-pyridine	C11-A008
Aminoalkohol	C01-C104
Aminocyclohexane	C11-A048
Aminocylcohexane	C11-A048
Aminoethane	C11-A068
Aminoethylene	C11-A072
Aminohexahydrobenzene	C11-A048
Aminometan	C11-A109
Aminometana	C11-A109
Aminometano	C11-A109
Aminomethane	C11-A109
Aminopyridine, 4-	C11-A008
Amiton	C01-A014
Amiton Hydrogen Oxalate	C01-A014
Amiton Oxalate	C01-A014
Amiton-4 {Methyl Sulfate Quaternary Amine}	C01-A014
Amma-Aminopyridine	C11-A008
Ammonia	C11-A009
Ammoniac	C11-A009
Ammoniaca	C11-A009
Ammoniak	C11-A009
Ammoniak Kconzentrierter	C11-A009
Ammoniakgas	C11-A009
Ammonium Acid Fluoride	C01-C080
Ammonium Bifluoride	C01-C080
Ammonium Difluoride	C01-C080
Ammonium Fluoride Hydrofluoride	C01-C080
Ammonium Fluoride, Acidic	C01-C080
Ammonium Hydrofluoride	C01-C080
Ammonium Hydrogen Bifluoride	C01-C080
Ammonium Hydrogen Difluoride	C01-C080
Ammonium Hydrogen Fluoride	C01-C080
Ammonium Monohydrogen Difluoride	C01-C080
Ammonium, (3-(Dimethylcarbamoyloxy)phenyl)diethylmethyl-, Iodide	C02-A050
Ammonium, (m-Hydroxyphenyl)diethylmethyl-, Chloride, Methylcarbamate	C02-A051
Ammonium, (m-Hydroxyphenyl)diethylmethyl-, Iodide, Dimethylcarbamate	C02-A050
Ammonium, Diethyl(m-hydroxyphenyl)methyl-, Iodide, Dimethylcarbamate	C02-A050

Amoniaco	C11-A009
Amoniak	C11-A009
Ampridine	C11-A008
Amprolene	C11-A071
Ampydin	C11-A008
Ampyra	C11-A008
AN	C11-A002
Anca 1040	C11-A022
Anhidrid Sumporaste Kiseline	C11-A154
Anhidrid Sumporne Kiseline	C11-A156
Anhidrida Sulfuric	C11-A156
Anhidrida Sulfuroasă	C11-A154
Anhídrido Sulfúrico	C11-A156
Anhídrido Sulfuroso	C11-A154
Anhiđrit Sunfurơ	C11-A154
Anhidruro del Ácido Sufúrico	C11-A156
Anhidruro del Ácido Sulfuroso	C11-A154
Anhydride Arsenique	C11-A011
Anhydride Sulfureux	C11-A154
Anhydride Sulfurique	C11-A156
Anhydride, Sulfurous	C11-A154
Anhyđrit Sulfuric	C11-A156
Anhydrous Ammonia	C11-A009
Anhydrous Hydriodic Acid	C11-A090
Anhydrous Hydrobromic Acid	C11-A087
Anhydrous Hydrochloric Acid	C11-A088
Anhydrous Hydrofluoric Acid	C11-A089
Anhydrous Hydrogen Bromide	C11-A087
Anhydrous Hydrogen Chloride	C11-A088
Anhydrous Hydrogen Fluoride	C11-A089
Anhydrous Methylamine	C11-A109
Anidride Solforica	C11-A156
Anidride Solforosa	C11-A154
Anidrido Sulfúrico	C11-A156
Anidrido Sulfuroso	C11-A154
Aniline, hexahydro-	C11-A048
Aniline, N-Dichloromethylene-	C10-A013
Ankilostin	C11-A136
Anprolene	C11-A071
Anproline	C11-A071
Anthium 200	C11-A038
Anthium Dioxcide	C11-A038
Antiblaze 75	C01-C090
Antibulit	C01-C077
Anticon	C11-A137
Antigal	C11-A051
Antimit	C03-A017
Antimonhydrid	C11-A153
Antimonovodík	C11-A153

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Antimontrihydrid	C11-A153
Antimonwasserstoff	C11-A153
Antimony Hydride	C11-A153
Antimony Trihydride	C11-A153
Antimoonhydride	C11-A153
Antimoontrihydride	C11-A153
Antisal 1	C11-A136
Antisol 1	C11-A136
Antlak	C11-A051
Antymonowodór	C11-A153
ANW-35630	C01-C058
ANW-36652	C01-C059
AO6475000	C11-A042
AO7150000	C11-A176
Apachlor	C11-A037
Apadrin	C11-A125
Apavap	C11-A055
Apavinfos	C11-A123
Apavinphos	C11-A123
Aphamite	C11-A133
Aphonite	C11-A154
Aprocarb	C11-A143
Aqua Care	C11-A038
Aqua Fortis	C11-A126
Aquaguard	C11-A055
Aquinite {Chloropicrin (75-80%) and Stannic Chloride (25-20%) Mixture}	C10-A006
Aragan	C11-A163
Aragran	C11-A163
Aralo	C11-A133
Arcton 11	C11-A081
Arcton 9	C11-A081
Aresenwasserstoff	C08-A001
Aromatic Ammonia	C11-A009
Arprocarb	C11-A143
Arrex E {Zinc Phosphide}	C11-A139
Arsane	C08-A001
Arsenenous Acid, Sodium Salt	C11-A151
Arsenic (3+) Chloride	C04-C006
Arsenic (III) Chloride	C04-C006
Arsenic (III) Oxide	C11-A012
Arsenic (III) Trichloride	C04-C006
Arsenic (III) Trioxide	C11-A012
Arsenic (V) Oxide	C11-A011
Arsenic (White)	C11-A012
Arsenic Acid	C11-A011
Arsenic Acid Anhydride	C11-A011
Arsenic Acid Hemihydrate	C11-A011
Arsenic Anhydride	C11-A011
Arsenic Butter	C04-C006
Arsenic Chloride	C04-C006

Arsenic Dichloroethane	C04-A001
Arsenic Hydride	C08-A001
Arsenic Oxide	C11-A011
Arsenic Oxide	C11-A012
Arsenic Oxide (3)	C11-A012
Arsenic Pentaoxide	C11-A011
Arsenic Pentoxide	C11-A011
Arsenic Sesquioxide	C11-A012
Arsenic Sodium Oxide	C11-A151
Arsenic Trichloride	C04-C006
Arsenic Trichloride, Phenyldichloroarsine, Diphenylchloroarsine and Triphenylarsine Mixture (Arsine Oil)	C04-A
Arsenic Trihydride	C08-A001
Arsenic Trioxide	C11-A012
Arsenic(5+) Oxide	C11-A011
Arsenic(III) Trioxide	C11-A012
Arsenic(V) Oxide	C11-A011
Arsenic(V) Pentoxide	C11-A011
Arsenic, Magnesium and Aluminum Alloy	C08-A
Arsenic, Magnesium and Aluminum Mixture	C08-A
Arsenicum Album	C11-A012
Arsenious Acid	C11-A012
Arsenious Acid, Monosodium Salt	C11-A151
Arsenious Acid, Sodium Salt	C11-A151
Arsenious Chloride	C04-C006
Arsenious Oxide	C11-A012
Arsenious Trioxide	C11-A012
Arsenitan Sodný	C11-A151
Arsenite	C11-A012
Arsenite de Sodium	C11-A151
Arsénite de Soude	C11-A151
Arsenite Sodium	C11-A151
Arsenito de Sodio	C11-A151
Arsenito de Sódio	C11-A151
Arsenito Sódico	C11-A151
Arseniuretted Hydrogen	C08-A001
Arsenolite	C11-A012
Arsenous Acid	C11-A012
Arsenous Acid Anhydride	C11-A012
Arsenous Anhydride	C11-A012
Arsenous Chloride	C04-C006
Arsenous Hydride	C08-A001
Arsenous Oxide	C11-A012
Arsenous Oxide Anhydride	C11-A012
Arsenous Trichloride	C04-C006
Arsenous Trioxide	C11-A012
Arsenowodor	C08-A001
Arsentrichlorid	C04-C006
Arsentrioxid	C11-A012

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Arsenwasserstoff	C08-A001
Arsine	C08-A001
Arsine Dichloride, Phenyl-	C04-A004
Arsine Oil	C04-A
Arsine, (2-chlorovinyl) Dichloro-	C04-A002
Arsine, (2-Chlorovinyl)dichloro-	C04-A002
Arsine, Dibromophenyl-	C04-A005
Arsine, Dichloro(2-chlorovinyl)-	C04-A002
Arsine, Dichloro(phenyl)-	C04-A004
Arsine, Dichloroethyl-	C04-A001
Arsine, Dichloromethyl	C04-A003
Arsine, Hexahydrate	C08-A001
Arsine, Monohydrate	C08-A001
Arsine, Tris(2-chloroethenyl)-	C04-C007
Arsine, Tris(2-chloroethenyl)-, (E,E,E)-	C04-C007
Arsonous Dibromide, Phenyl	C04-A005
Arsonous Dichloride, (2-Chloroethenyl)	C04-A002
Arsonous Dichloride, (2-Chloroethenyl)-	C04-A002
Arsonous Dichloride, [(1Z)-2-Chloroethenyl]-	C04-A002
Arsonous Dichloride, As-(2-chloroethenyl)-	C04-A002
Arsonous Dichloride, As-ethyl-	C04-A001
Arsonous Dichloride, As-methyl-	C04-A003
Arsonous Dichloride, As-phenyl-	C04-A004
Arsonous Dichloride, Ethyl-	C04-A001
Arsonous Dichloride, Methyl-	C04-A003
Arsonous Dichloride, Phenyl-	C04-A004
Arthur	C08-A001
Artificial Mustard Oil	C11-A007
Artificial Oil of Mustard	C11-A007
Asahi Perchlor	C11-A136
Asetyloksi(fenyyli)elohopea	C11-A137
Asid Borofluorik	C11-A169
Asid Fluoborik	C11-A169
Asid Fluoroborik	C11-A169
Asid Hidrofluoroborik	C11-A169
Aska-Rid	C11-A030
ASP 47	C11-A161
Astrobot	C11-A055
Asulfa-Supra	C01-C061
AT5250000	C11-A002
Atgard	C11-A055
Atlas A	C11-A151
Atomic Sulfur	C01-C061
Avitrol	C11-A008
Axit Pecloric	C11-A135
Azaciclohexana	C11-A141
Azaciclohexano	C11-A141
Azacikloheksan	C11-A141
Azacyclohexaan	C11-A141
Azacyclohexane	C11-A141

Azacyclopropane	C11-A072
Azacyklohexan	C11-A141
Azane	C11-A009
Azimil	C11-A013
Azinaan	C11-A141
Azinan	C11-A141
Azinane	C11-A141
Azinano	C11-A141
Azinfos-methyl	C11-A013
Azinophos-methyl	C11-A013
Azinphos	C11-A013
Azinphos M	C11-A013
Azinphos-Me	C11-A013
Azinphos-methyl	C11-A013
Azinphos-metile	C11-A013
Azinugec	C11-A013
Azirane	C11-A072
Aziridina, 2-Metil	C11-A145
Aziridine	C11-A072
Aziridine, 2-Methyl-	C11-A145
Azodrin	C11-A125
Azofos	C11-A120
Azophos	C11-A120
Azot Dioksid	C11-A128
Azot Trifluorid	C11-A129
Azot(IV) Oksid	C11-A128
Azotan Rtęci(II)	C11-A097
Azot-dioksid	C11-A128
Azote	C11-A128
Azotic Acid	C11-A126
Azot-monoksid	C11-A127
Azoto	C11-A128
Azot-oksid	C11-A127
Azotowy Kwas	C11-A126
Azotoyperite	C03-A017
- B -	
((Butylthio)methyl) O,O-Diethyl Phosphorodithioate	C11-A163
(beta-Chloroethyl)diisopropylamine Hydrochloride	C01-C
(Bis(2-chloroethyl) Sulfoxide)	C03-D056
[(Bromoethoxyphosphinyl)oxy]carbonimidic Chloride Fluoride	C01-C122
B {Sulfur Mustard and Arsine Oil Mixture}	C03-A
B 404	C11-A133
B1	C03-A001
BA5075000	C11-A004
BA5425000	C11-A005
Baran	C11-A077
Baron	C11-A077
Basle Green	C11-A046
Bassadinon	C11-A051

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Basudin	C11-A051
Bay 1605	C11-A133
Bay 5024	C11-A106
Bay 5081	C11-A075
Bay 5546	C11-A103
Bay 8169	C11-A050
Bay 9026	C11-A106
Bay 9027	C11-A013
Bay 10756	C11-A050
Bay 11405	C11-A120
Bay 17147	C11-A013
Bay 19149	C11-A055
Bay 19639	C11-A062
Bay 37289	C11-A075
Bay 37344	C11-A106
Bay 45432	C11-A131
Bay 68138	C11-A074
Bay 70143	C11-A032
Bay 71628	C11-A103
Bay 78537	C11-A032
Bay E-393	C11-A161
Bay E-605	C11-A133
Bay G-393	C11-A161
Bazanon	C11-A051
Bazuden	C11-A051
Bazudine	C11-A051
BB	C03-A001
BBC 12	C11-A053
BBCP	C11-A053
BBL028105	C01-C058
BC {Phosgene (50%) and Chlorine (50%) Mixture}	C10-A003
BCEE	C11-A017
BCME	C10-A011
BDBM50240986	C11-A063
Bencarbate	C11-A014
Bendiocarbe	C11-A014
Benfos	C11-A055
Bensulfoid	C01-C061
Benzenamine, 2-Methoxy-	C11-A010
Benzenamine, Ar-methoxy-	C11-A010
Benzenamine, hexahydro-	C11-A048
Benzenamine, N-(Dichloromethylene)-	C10-A013
Benzenaminium, 3-[[(Dimethylamino)carbonyl]oxy]-N,N,N-trimethyl-5-[2-[4-(trimethylammonio) phenoxy]ethoxy]-, Diiodide	C02-A011
Benzenaminium, 3-[[(Dimethylamino)carbonyl]oxy]-N,N,N-trimethyl-5-[3-[3-(trimethylammonio) phenoxy]propoxy]-, Diiodide	C02-A012
Benzenaminium, 5-[[(Dimethylamino)carbonyl]oxy]-N,N,N-trimethyl-2-[3-[4-(trimethylammonio) phenoxy]propoxy]-, Diiodide	C02-A027
Benzenaminium,N,N,N-trimethyl-3-[[(methylamino)carbonyl]oxy]-, Chloride	C02-A051
Benzene, (Acetoxymercuri)-	C11-A137

Benzene, (Dichloromethylsilyl)-	C11-A121
Benzene, 1,1'-Methylenebis(4-isocyanato-	C11-A113
Benzene, 1,3-Diisocyanato-2-methyl-	C11-A174
Benzene, 1,3-Diisocyanatomethyl-	C11-A173
Benzene, 1,3-Diisocyanatomethyl-	C11-A174
Benzene, 2,4-Diisocyanato-1-methyl	C11-A173
Benzene, 2,6-Diisocyanato-1-methyl	C11-A174
Benzene,4-diisocyanato-1-methyl-	C11-A173
Benzenephosphonic Acid, Ethyl-(p-nitrophenyl) Ester	C11-A064
Benzenephosphonic Acid, Thiono-, Ethyl-(p-nitrophenyl) Ester	C11-A064
Benzenephosphothionic Acid, Ethyl-4-nitrophenyl Ester	C11-A064
Benzo[e][1,3,2]dioxathiepin-3-oxide	C11-A063
Benzodioxol-4-ol, 2,2-Dimethyl-, Methylcarbamate	C11-A014
Benzodioxole, 2,2-Dimethyl-4-(N-methylaminocarboxylato)-	C11-A014
Benzoepin	C11-A063
Benzofuran-7-ol, 2,3-Dihydro, 2,2-Dimethyl, N-Methylcarbamate	C11-A032
Benzotriazinedithiophosphoric Acid Dimethoxy Ester	C11-A013
Benzyl Alcohol, 2,4-Dichloro-alpha-(chloromethylene)-, Diethyl Phosphate	C11-A037
Benzyl Alcohol, 2,4-Dichloro-α-(chloromethylene)-, Diethyl Phosphate	C11-A037
Beosit	C11-A063
Bercema	C11-A110
Bertholite	C10-A001
Beryllium Sulfate	C11-A015
Beryllium Sulphate	C11-A015
Beta Sulfur	C01-C061
beta-(Diethylamino)ethanol	C01-C103
beta-(Diethylamino)ethyl Alcohol	C01-C103
beta-(Diisopropylamino)ethyl Chloride	C01-C
beta-(Dimethylamino)ethyl Chloride	C01-C099
beta-(N,N-Dimethylamino)ethyl Chloride	C01-C099
beta,beta'-Dichlorodiethyl Ether	C11-A017
beta,beta'-Dichlorodiethyl Sulfide	C03-A001
beta,beta'-Dichlorodiethyl-N-methylamine	C03-A017
beta,beta'-Dichloroethyl Sulfide	C03-A001
beta,beta'-Dichloroethyl Sulphide	C03-A001
beta,beta'-Dihydroxydiethyl Sulfide	C03-C037
beta,beta'-Dihydroxyethyl Sulfide	C03-C037
beta-6,7,8,9,10,10-Hexachloro-1,5,5a,6,9,9a-hexahydro-endo-6,9-methano-2,4,3-benzodioxathiepin 3-oxide	C11-A063
beta-Benzoepin	C11-A063
beta-Bis(hydroxyethyl) Sulfide	C03-C037
beta-Chloroethanol	C03-C041
beta-Chloroethyl Alcohol	C03-C041
beta-Chloroethyl Vinyl Sulfide	C03-D054
beta-Chloroethyldimethylamine	C01-C099
beta-Chloroethylisobutyl Sulfide	C03-A001
beta-Chloroethyl-N,N-dimethylamine Hydrochloride	C01-C099
beta-Chlorovinylarsenious Oxide	C04-D008
beta-Chlorovinylbichloroarsine	C04-A002

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beta-Chlorovinyldichloroarsine	C04-A002
beta-CVP	C11-A037
beta-Diethylaminoethanol	C01-C103
beta-Diethylaminoethyl Alcohol	C01-C103
beta-Diisopropylaminoethanethiol	C01-C105
beta-Dimethylaminoethyl Chloride Hydrochloride	C01-C099
beta-Endosulfan	C11-A063
beta-Ethylmercaptoethyl Diethyl Thionophosphate	C11-A050
beta-Fluoroethanol	C11-A079
beta-Fluoroethyl Fluoroacetate	C11-A080
beta-Hydroxyethyl Chloride	C03-C041
beta-Hydroxyethyl Sulfide	C03-C037
beta-Hydroxytriethylamine	C01-C103
beta-Methallyl Chloride	C11-A102
beta-Methylacrolein	C11-A047
beta-Methylallyl Chloride	C11-A102
beta-Thiodan	C11-A063
beta-Thiodiglycol	C03-C037
beta-Thionex	C11-A063
BFP	C11-A058
BFPO	C11-A058
BFV	C11-A083
B-H	C11-A052
BI IV 99 {Arsenic, Magnesium and Aluminum Mixture}	C08-A
Biafine	C03-C045
Bibesol	C11-A055
Bibi	C10-A012
BIC	C11-A028
Bichloride of Mercury	C11-A096
Bichlorure d'Ethylene	C11-A070
Bichlorure de Mercure	C11-A096
Bicloruro de Mercurio	C11-A096
Bidirl	C11-A056
Bidrin	C11-A056
Bifenthrine	C11-A016
Bifentrin	C11-A016
Bifex	C11-A143
Bifluoriden	C11-A076
Bifluorure de Potassium	C01-C078
Biloborn	C11-A125
Bilobran	C11-A125
Binary A-232	C01-A037
Binary GB	C01-A002
Binary GD	C01-A003
Binary VR	C01-A016
Binary VX	C01-A017
Biocel	C11-A134
Biologen	C11-A038
Biossido di Zolfo	C11-A154
Biosukegawa 1000	C11-A038

Biotalk	C11-A038
Bioxyde D'azote	C11-A127
Biphenate	C11-A016
Biphenthrin	C11-A016
Biphentrin	C11-A016
Bipyridinium, 1,1'-dimethyl-4,4'-, Dichloride	C11-A132
Birlan	C11-A037
Birlane	C11-A037
Bis (Trichloro Methyl) Carbonate	C10-A005
Bis(1,4-isocyanatophenyl)methane	C11-A113
Bis(1-methylethyl)ethylamine	C01-D176
Bis(2-chloroethyl) 1-Methylpropylamine	C03-A035
Bis(2-chloroethyl) 1-Propene Amine	C03-A027
Bis(2-chloroethyl) 2-Fluoroethylamine	C03-A022
Bis(2-chloroethyl) 2-Propanamine	C03-A029
Bis(2-chloroethyl) 3-Chloropropylamine	C03-A028
Bis(2-chloroethyl) Butylamine	C03-A036
Bis(2-chloroethyl) Disulfide	C03-D
Bis(2-chloroethyl) Ether	C11-A017
Bis(2-chloroethyl) Isobutylamine	C03-A035
Bis(2-chloroethyl) Isopropylamine	C03-A029
Bis(2-chloroethyl) Pertrisulfide	C03-D057
Bis(2-chloroethyl) Propylamine	C03-A030
Bis(2-chloroethyl) s-Butylamine	C03-A034
Bis(2-chloroethyl) Sulfide	C03-A001
Bis(2-chloroethyl) Sulfone	C03-D055
Bis(2-chloroethyl) Sulfoxide	C03-D056
Bis(2-chloroethyl) Sulphone	C03-D055
Bis(2-chloroethyl) Sulphoxide	C03-D056
Bis(2-chloroethyl) t-Butylamine	C03-A033
Bis(2-chloroethyl) tert-Butylamine	C03-A033
Bis(2-chloroethyl) Trisulfide	C03-D057
Bis(2-chloroethyl)(methylethyl)amine	C03-A029
Bis(2-chloroethyl)-2-butanamine	C03-A034
Bis(2-chloroethyl)ethylamine	C03-A016
Bis(2-chloroethyl)ethylamine Hydrochloride	C03-A016
Bis(2-chloroethyl)methylamine	C03-A017
Bis(2-chloroethyl)methylamine Hydrochloride	C03-A017
Bis(2-chloroethyl)-N-methylamine Hydrochloride	C03-A017
Bis(2-chloroethyl)sulfide	C03-A001
Bis(2-chloroethylthio)ethane	C03-A002
Bis(2-chloroethylthio)methane	C03-A011
Bis(2-chloroethylthioethyl) Ether	C03-A003
Bis(2-chloroethylthioethyl)ether	C03-A003
Bis(2-chloroethylthiomethyl) Ether	C03-A015
Bis(2-chloroethylthiomethyl)ether	C03-A015
Bis(2-chloromethyl) Ether	C10-A011
Bis(2-chloropropyl) Chloroethylamine	C03-A032
Bis(2-chloropropyl) Methylamine	C03-A031

(*Continued*)

Bis(2-diisopropylaminoethyl) Disulfide	C01-D167
Bis(2-diisopropylaminoethyl) Sulfide	C01-D166
Bis(2-diisopropylaminoethyl) Thioether	C01-D166
Bis(2-fluoroethyl) 2-Chloroethylamine	C03-A023
Bis(2-fluoroethyl)methylamine	C03-A019
Bis(2-hydroxyethyl) Sulfide	C03-C037
Bis(2-hydroxyethyl) Sulphide	C03-C037
Bis(2-hydroxyethyl) Thioether	C03-C037
Bis(2-hydroxyethyl)amine	C03-D060
Bis(2-hydroxyethyl)methylamine	C03-C043
Bis(2-hydroxyethyl)sulfide	C03-C037
Bis(2-hydroxyethyl)tallow Amine Oxide	C03-D060
Bis(4-isocianatofenil)metano	C11-A113
Bis(4-isocyanatophenyl)methane	C11-A113
Bis(acetato)hexametaarsenitotetracopper	C11-A046
Bis(beta-chloroethyl) Sulfide	C03-A001
Bis(beta-chloroethyl) Sulfone	C03-D055
Bis(beta-chloroethyl) Sulfoxide	C03-D056
Bis(beta-chloroethyl)ethylamine	C03-A016
Bis(beta-chloroethyl)methylamine	C03-A017
Bis(beta-chloroethyl)sulfone	C03-D055
Bis(beta-chloroethyl)sulfoxide	C03-D056
Bis(beta-chloroethylthio)ethane	C03-A002
Bis(beta-hydroxyethyl) Sulfide	C03-C037
Bis(bisdimethylaminophosphonous) Anhydride	C11-A148
Bis(bromomethyl) Ether	C10-A012
Bis(chlormethyl)ether	C10-A011
Bis(chloro-2-ethyl) Oxide	C11-A017
Bis(chloroethyl)ether	C11-A017
Bis(chloromethyl)ether	C10-A011
Bis(cyclohexyl)carbodiimide	C01-C056
Bis(diethylamino)methaneimine	C01-C108
Bis(diisopropylaminoethyl) Disulfide	C01-D167
Bis(dimethylamido)fluorophosphate	C11-A058
Bis(dimethylamido)fluorophosphine Oxide	C11-A058
Bis(dimethylamido)phosphoryl Fluoride	C11-A058
Bis(dimethylamino)fluorophosphate	C11-A058
Bis(dimethylamino)fluorophosphine Oxide	C11-A058
Bis(dimethylamino)phosphinoyl Fluoride	C11-A058
Bis(dimethylamino)phosphonous Anhydride	C11-A148
Bis(dimethylamino)phosphoric Anhydride	C11-A148
Bis(dimethylamino)phosphorofluoridate	C11-A058
Bis(dithiophosphate de O,O-Diethyle) de S,S'-(1,4-Dioxanne-2,3-diyle)	C11-A061
Bis(ethenyl)sulfone	C03-D049
Bis(hydroxyethyl)amine	C03-D060
Bis(hydroxymethyl)phosphine Oxide	C01-C085
Bis(isopropyl)amine	C01-D174
Bis(isopropyl)ethylamine	C01-D176
Bis(O,O-diethylphosphorothionic) Anhydride	C11-A161
Bis(para-isocyanatophenyl)methane	C11-A113

Bis(p-isocyanatophenyl)methane	C11-A113
Bis(S-(diethoxyphosphinothioyl)mercapto)methane	C11-A065
Bis(β-chloroethyl) Ether	C11-A017
Bis(β-chloroethyl) Sulfide	C03-A001
Bis(β-chloroethyl) Sulfone	C03-D055
Bis(β-chloroethyl) Sulfoxide	C03-D056
Bis(β-chloroethyl)ethylamine	C03-A016
Bis(β-Chloroethyl)methylamine	C03-A017
Bis(β-chloroethyl)sulfone	C03-D055
Bis(β-chloroethyl)sulfoxide	C03-D056
Bis(β-chloroethylthio)ethane	C03-A002
Bis(β-hydroxyethyl) Sulfide	C03-C037
Bis[2(2-chloroethylthio)ethyl] Ether	C03-A003
Bis[2-(diisopropylamino)ethyl] Disulfide	C01-D167
Bis[2-(diisopropylamino)ethyl] Sulfide	C01-D166
Bis[O,O-diethylphosphoric Anhydride]	C11-A167
Bis{2-[(2-chloroethyl)sulfanyl]ethyl} Ether	C03-A003
Bis{alpha-[(3-dimethylcarbamoxy-alpha-picolinyl)pyrrolidinio]}-4,4'-biacetophenone Di (hydrogenoxalate)	C02-A026
Bis{alpha-[(3-dimethylcarbamoxy-alpha-picolinyl)pyrrolidinio]}-4,4'-biacetophenone Di (hydrogensulfate)	C02-A026
Bis{alpha-[(3-dimethylcarbamoxy-alpha-picolinyl)pyrrolidinio]}-4,4'-biacetophenone Dibromide	C02-A026
Bis{alpha-[(3-dimethylcarbamoxy-alpha-picolinyl)pyrrolidinio]}-4,4'-biacetophenone Dinitrate	C02-A026
Bis{alpha-[(3-dimethylcarbamoxy-alpha-picolinyl)pyrrolidinio]}-4,4'-biacetophenone Diperchlorate	C02-A026
Bis{alpha-[(3-dimethylcarbamoxyphenyl)methylamino]}-4,4'-biacetophenone Dimethobromide	C02-A024
Bis{alpha-[(3-dimethylcarbamoxyphenyl)methylamino]}-4,4'-biacetophenone Dinitrate	C02-A024
Bis{alpha-[(3-dimethylcarbamoxyphenyl)methylamino]}-4,4'-biacetophenone Diperchlorate	C02-A024
Bis{α-[(3-dimethylcarbamoxyphenyl)methylamino]}-4,4'-biacetophenone Di(hydrogenoxalate)	C02-A024
Bis{α-[(3-dimethylcarbamoxyphenyl)methylamino]}-4,4'-biacetophenone Di(hydrogensulfate)	C02-A024
Bis{α-[(3-dimethylcarbamoxyphenyl)methylamino]}-4,4'-biacetophenone Dimethobromide	C02-A024
Bis{α-[(3-dimethylcarbamoxyphenyl)methylamino]}-4,4'-biacetophenone Dinitrate	C02-A024
Bis{α-[(3-dimethylcarbamoxyphenyl)methylamino]}-4,4'-biacetophenone Diperchlorate	C02-A024
Bis{α-[(3-dimethylcarbamoxy-α-picolinyl)pyrrolidinio]}-4,4'-biacetophenone Di(hydrogen Methosulfate)	C02-A026
Bis{α-[(3-dimethylcarbamoxy-α-picolinyl)pyrrolidinio]}-4,4'-biacetophenone Di(hydrogen Methoxalate)	C02-A026
Bis{α-[(3-dimethylcarbamoxy-α-picolinyl)pyrrolidinio]}-4,4'-biacetophenone Di(hydrogenoxalate)	C02-A026
Bis{α-[(3-dimethylcarbamoxy-α-picolinyl)pyrrolidinio]}-4,4'-biacetophenone Di(hydrogensulfate)	C02-A026
Bis{α-[(3-dimethylcarbamoxy-α-picolinyl)pyrrolidinio]}-4,4'-biacetophenone Dibromide	C02-A026
Bis{α-[(3-dimethylcarbamoxy-α-picolinyl)pyrrolidinio]}-4,4'-biacetophenone Dimethohydrogenoxalate	C02-A026
Bis{α-[(3-dimethylcarbamoxy-α-picolinyl)pyrrolidinio]}-4,4'-biacetophenone Dimethonitrate	C02-A026
Bis{α-[(3-dimethylcarbamoxy-α-picolinyl)pyrrolidinio]}-4,4'-biacetophenone Dimethoperchlorate	C02-A026
Bis{α-[(3-dimethylcarbamoxy-α-picolinyl)pyrrolidinio]}-4,4'-biacetophenone Dimethosulfate	C02-A026
Bis{α-[(3-dimethylcarbamoxy-α-picolinyl)pyrrolidinio]}-4,4'-biacetophenone Dinitrate	C02-A026
Bis{α-[(3-dimethylcarbamoxy-α-picolinyl)pyrrolidinio]}-4,4'-biacetophenone Diperchlorate	C02-A026
Bis-2-chloroethylether	C11-A017
Bis-2-hydroxyethylamine	C03-D060
Bis-CME	C10-A011

(*Continued*)

Bisdimethylaminofluorophosphine Oxide	C11-A058
Bis-N,N,N',N'-tetramethylphosphorodiamidic Anhydride	C11-A148
BL {Magnesium Arsenide}	C08-C
Bladafume	C11-A161
Bladan	C11-A133
Bladan	C11-A167
Bladan M	C11-A120
Blattanex	C11-A143
Blattosep	C11-A143
Blausaeure	C07-A001
Blauwzuur	C07-A001
Bleitetraäthylen	C11-A168
Bleitetraethyl	C11-A168
Bleitetramethyl	C11-A170
Blister Gas No. 1	C03-A001
Blister Gas No. 2	C03-A001
Blister Gas No. 3	C04-A002
Blister Gas No. 4	C03-A005
Blister Gas No. 5	C03-A016
Blood Gas	C07-A001
Blue Agents	C10-A
Blue Cross No. 1 (German WWI Shell) {Phenyldichloroarsine (60-50%) and Diphenylchloroarsine (40-50%) Mixture}	C04-A
Blue No. 1	C10-A003
Blue Star (British WWI Cylinder Gas) {Chlorine (80%) and Sulfur Chloride (20%) Mixture}	C10-A
Blytetraetyl	C11-A168
BMM	C11-A110
BO0875000	C11-A009
BOC {Phosgene and Stannic Chloride Mixture}	C10-A003
BOC {Phosgene, Chlorine and Stannic Chloride Mixture}	C10-A
Bolfo	C11-A143
Bomyl	C11-A018
Bonide Antzix	C11-A171
Bonide Sulfur Plant Fungicide	C01-C061
Bonoform	C11-A165
Boomer-rid	C11-A159
Boorfluorwaterstof	C11-A169
Borane	C11-A052
Borane, Tribromo-	C11-A019
Borane, Trichloro-	C11-A020
Borane, Trifluoro-	C11-A022
Boranylidyneborane	C11-A052
Borate(1-), Tetrafluoro-, Hydrogen	C11-A169
Borate(1-), Tetraphenyl-, 1-[[2-[[(Dimethylamino)carbonyl]oxy]phenyl]methyl]-2,5-dihydro-1-[8-(trimethylammonio)octyl]-1H-pyrrolium	C02-A030
Borate(1-), Tetraphenyl-, 1-[[2-[[(Dimethylamino)carbonyl]oxy]phenyl]methyl]-2,5-dihydro-1-[8-(trimethylammonio)octyl]-1H-pyrrolium	C02-A030
Borate(1-), Tetraphenyl-, 1-[[2-[[(Dimethylamino)carbonyl]oxy]phenyl]methyl]-2,5-dihydro-1-[10-(trimethylammonio)decyl]-1H-pyrrolium	C02-A040

Borate(1-), Tetraphenyl-, 1-[[2-[[(Dimethylamino)carbonyl]oxy]phenyl]methyl]-2,5-dihydro-1-[10-(trimethylammonio)decyl]-1H-pyrrolium	C02-A040
Borate(1-), Tetraphenyl-, 1-[10-[[[3-[[(Dimethylamino)carbonyl]oxy]-2-pyridinyl]methyl] dimethylammonio]decyl]-4-[(hydroxyimino)methyl]pyridinium	C02-A039
Borate(1-), Tetraphenyl-, 1-[10-[[[3-[[(Dimethylamino)carbonyl]oxy]-2-pyridinyl]methyl] dimethylammonio]decyl]-4-[(hydroxyimino)methyl]pyridinium	C02-A039
Borate(1-), Tetraphenyl-, 5-[[(Dimethylamino)carbonyl]oxy]-2-[10-(trimethylammonio)decyl] isoquinolinium	C02-A029
Borate(1-), Tetraphenyl-, 5-[[(Dimethylamino)carbonyl]oxy]-2-[10-(trimethylammonio)decyl] isoquinolinium	C02-A029
Borate(1-), Tetraphenyl-, N,N'-Bis[10-[[[3-[[(Dimethylamino)carbonyl]oxy]-2-pyridinyl]methyl] dimethylammonio]decyl]-N,N,N',N'-tetramethyl-1,10-decanediaminium	C02-A049
Borate(1-), Tetraphenyl-, N-[[2-[[(Dimethylamino)carbonyl]oxy]phenyl]methyl]-N,N,N',N',N'-pentamethyl-1,8-octanediaminium	C02-A028
Borate(1-), Tetraphenyl-, N-[[2-[[(Dimethylamino)carbonyl]oxy]phenyl]methyl]-N,N,N',N',N'-pentamethyl-1,8-octanediaminium	C02-A028
Borate(1-), Tetraphenyl-, N-[[3-[[(Dimethylamino)carbonyl]oxy]-2-pyridinyl]methyl]-N',N'-bis(2-hydroxyethyl)-N,N,N'-trimethyl-1,10-decanediaminium	C02-A038
Borate(1-), Tetraphenyl-, N-[[3-[[(Dimethylamino)carbonyl]oxy]-2-pyridinyl]methyl]-N',N'-bis(2-hydroxyethyl)-N,N,N'-trimethyl-1,10-decanediaminium	C02-A038
Borate(1-), Tetraphenyl-, N-[[3-[[(Dimethylamino)carbonyl]oxy]-2-pyridinyl]methyl]-N'-[(3-hydroxy-2-pyridinyl)methyl]-N,N,N',N'-tetramethyl-1,10-decanediaminium	C02-A044
Borate(1-), Tetraphenyl-, N-[[3-[[(Dimethylamino)carbonyl]oxy]-2-pyridinyl]methyl]-N'-[(3-hydroxy-2-pyridinyl)methyl]-N,N,N',N'-tetramethyl-1,10-decanediaminium	C02-A044
Borate(1-), Tetraphenyl-, N-[[4-[[[(Dimethylamino)carbonyl]oxy]methyl]phenyl]methyl]-N'-[[3-[[(dimethylamino)carbonyl]oxy]-2-pyridinyl]methyl]-N,N,N',N'-tetramethyl-1,10-decanediaminium	C02-A048
Borate(1-), Tetraphenyl-, N-[[4-[[[(Dimethylamino)carbonyl]oxy]methyl]phenyl]methyl]-N'-[[3-[[(dimethylamino)carbonyl]oxy]-2-pyridinyl]methyl]-N,N,N',N'-tetramethyl-1,10-decanediaminium	C02-A048
Borer Sol	C11-A070
Borfluorwasserstoffsäure	C11-A169
Boroethane	C11-A052
Borofluoric Acid	C11-A169
Boron Bromide	C11-A019
Boron Chloride	C11-A020
Boron Fluoride	C11-A022
Boron Hydride	C11-A052
Boron Tribromide	C11-A019
Boron Trichloride	C11-A020
Boron Triflouride	C11-A022
Boron Trifluoride	C11-A022
Boron Trifluride	C11-A022
Boron(III) Bromide	C11-A019
Bortrifluorid	C11-A022
Boruho	C11-A143
Bostex 410	C01-C061
BOV	C11-A157
BP-20548	C01-C058
BQ9200000	C01-C080
BR	C04-C006
Brassica Seed Oil	C11-A007

(*Continued*)

Bravik	C11-A120
Brevinyl	C11-A055
Brifer	C11-A032
Brifur	C11-A032
Brigade	C11-A016
Brimstone	C01-C061
Brimstone Acid	C11-A157
Brocide	C11-A070
Brom	C10-A002
Bromacetylen	C11-A164
Broman	C11-A087
Bromane	C11-A087
Bromanylmethane	C11-A110
Brome	C10-A002
Bromine	C10-A002
Bromine Chloride	C11-A021
Bromine Chlorine	C11-A021
Bromine Cyanide	C07-A002
Bromine Element	C10-A002
Bromine Fluoride	C11-A023
Bromine Fluoride	C11-A024
Bromine Molecule	C10-A002
Bromine Monochloride	C11-A021
Bromine Monocyanide	C07-A002
Bromine Pentafluoride	C11-A023
Bromine Trifluoride	C11-A024
Bromine(1) Chloride	C11-A021
Bromine(I) Chloride	C11-A021
Brommetan	C11-A110
Brommethan	C11-A110
Brommethyl	C11-A110
Brommethylather	C10-A012
Bromo	C10-A002
Bromo Bromide	C10-A002
Bromo Chloride	C11-A021
Bromo HN3	C03-A021
Bromo(bromomethoxy)methane	C10-A012
Bromo-2,5-dichlorophenyl) O,O-Diethyl Phosphorothioate	C11-A025
Bromocarbon	C11-A110
Bromocyan	C07-A002
Bromocyanide	C07-A002
Bromocyanogen	C07-A002
Bromofos-ethyl	C11-A025
Bromofume	C11-A069
Brom-O-gas	C11-A110
Brom-O-gaz	C11-A110
Bromohydride	C11-A087
Bromometan	C11-A110
Bromometano	C11-A110
Bromomethane	C11-A110

Bromomethyl Ether	C10-A012
Bromomthane	C11-A110
Bromonitrile Oxide	C05-A002
Bromophos-ethyl	C11-A025
Bromopicrin	C10-A007
Brom-O-sol	C11-A110
Bromotrifluoride	C11-A024
Bromovodík	C11-A087
Bromowodor	C11-A087
Brompikrin	C10-A007
Bromur di Metile	C11-A110
Bromură de Metal	C11-A110
Bromurdimetile	C11-A110
Bromure D'hydrogene	C11-A087
Bromure D'hydrogene Anhydre	C11-A087
Bromure de Methyle	C11-A110
Bromuro de Hidrogeno Anhidro	C11-A087
Bromuro de Metilo	C11-A110
Bromuro di Etile	C11-A069
Bromuro di Metile	C11-A110
Bromwasserstoff	C11-A087
Broom	C10-A002
Broommethaan	C11-A110
Broomwaterstof	C11-A087
Brown Agents	C07-A
Brown No. 1	C07-A001
Brygou	C11-A143
BSF23SJ79E	C11-A109
BT2275000	C01-C162
BTC	C10-A005
Bufen	C11-A137
But-1-ene-1,3-dione	C11-A057
But-2-enal	C11-A047
But-2-yl Chloroformate	C11-A027
But-3-en-3-olide	C11-A057
But-3-ène-3-olide	C11-A057
Butan-2-yl Carbonochloridate	C11-A027
Butan-2-yl Chloroformate	C11-A027
Butane, 1,4-Bis[(2-chloroethyl)thio]-	C03-A012
Butane, 1-Isocyanato-	C11-A028
Butanimidamide, N,N-Diethyl- {Novichok Precursor}	C01-C
Butanimidamide, N,N-Diisopropyl- {Novichok Precursor}	C01-C
Butanimidamide, N,N-Dimethyl- {Novichok Precursor}	C01-C
Butanimidamide, N,N-Dipropyl- {Novichok Precursor}	C01-C
Butanimidoyl Chloride, N-[(Chloropropoxyphosphinyl)oxy]-	C01-C148
Butanimidoyl Chloride, N-[(Dichlorophosphinyl)oxy]-	C01-C132
Butanimidoyl Chloride, N-[[Chloro(1-methylethoxy)phosphinyl]oxy]-	C01-C150
Butanimidoyl Chloride, N-[[Chloro(2-methylpropoxy)phosphinyl]oxy]-	C01-C153
Butanisocyanate	C11-A028

(*Continued*)

Butoflin	C11-A049
Butoss	C11-A049
Butox	C11-A049
Butoxycarbonyl Chloride	C11-A026
Butter of Arsenic	C04-C006
Butyl Carbonochloridate	C11-A026
Butyl Chlorocarbonate	C11-A026
Butyl Chloroformate	C11-A026
Butyl Isocyanate	C11-A028
Butyl Isocyanate(n-)	C11-A028
Butyl Isocyanate(normal-)	C11-A028
Butyl Isocynate	C11-A028
Butylamine, N,N-Bis(2-chloroethyl)-	C03-A036
Butyl-bis-(2-chlor-athyl)-amin	C03-A036
Butyl-bis-(2-chloro-ethyl)amine	C03-A036
Butylisocyanate	C11-A028
Butyloxycarbonyl Chloride	C11-A026
BZ5410000	C11-A010
- C -	
(Cyanoguanidino)methylmercury	C11-A119
(Cyclohexyloxy)(methyl)phosphinic Acid	C01-C072
[(Chloro-2-chloroethoxyphosphinyl)oxy]carbonimidic Chloride Fluoride	C01-C121
[(Chloroethoxyphosphinyl)oxy]carbonimidic Chloride Fluoride	C01-C123
[(Chloroethoxyphosphinyl)oxy]carbonimidic Difluoride	C01-C126
[(Chloroisopropoxyphosphinyl)oxy]carbonimidic Difluoride	C01-C137
[(Chloromethoxyphosphinyl)oxy]carbonimidic Chloride Fluoride	C01-C115
[(Chloromethoxyphosphinyl)oxy]carbonimidic Dichloride	C01-C117
[(Chloromethoxyphosphinyl)oxy]carbonimidic Difluoride	C01-C118
[(Chloropropoxyphosphinyl)oxy]carbonimidic Dichloride	C01-C135
[(Chloropropoxyphosphinyl)oxy]carbonimidic Difluoride	C01-C136
[(Chlorosulfonyl)oxy]methane	C10-A009
[[Chloro(1-methylethoxy)phosphinyl]oxy]carbonimidic Chloride Fluoride	C01-C129
[[Chloroisopropylphosphinyl]oxy]carbonimidic Chloride Fluoride	C01-C129
[[Chloroisopropylphosphinyl]oxy]carbonimidic Dichloride	C01-C133
[[Chloropropylphosphinyl]oxy]carbonimidic Chloride Fluoride	C01-C130
C	C10-A003
C {Sulfur Mustard and Chlorobenzene Mixture}	C03-A001
C 6-Base	C03-A018
C 6-Salz	C03-A018
C,C-Dibromoformaldoxime	C05-A002
C.F.S.	C11-A171
C.I. 77410	C11-A046
C.I. Pigment Green 21	C11-A046
C56	C11-A085
C60TQU15XY	C11-A060
CA {Phosgene (50%) and Chloropicrin (50%) Mixture}	C10-A
Cachectin	C01-A005
Cadmium	C11-A030
Cadmium Fume	C11-A030
Cadmium Monoxide	C11-A030

Cadmium Oxide Brown	C11-A030
Cadmium Oxide Fume	C11-A030
Cadmium(II) Oxide	C11-A030
Cadusaphos	C11-A031
Calcid	C07-C007
Calcium Arsenide	C08-C003
Calcium Cyanide	C07-C007
Calcium Phosphide	C11-A139
Calcium Photophor {Calcium Phosphide}	C11-A139
Calcium;Dicyanide	C07-C007
Calcyan	C07-C007
Calcyanide	C07-C007
Calochlor	C11-A096
Calocure	C11-A096
Campiellite	C07-A002
Campilit	C07-A002
Campillit	C07-A002
Canogard	C11-A055
Capfos	C11-A082
Capture	C11-A016
Carbacryl	C11-A002
Carbamic Acid, 2,2-Dimethyl-2,3-dihydrobenzofuran-7-yl Ester	C11-A032
Carbamic Acid, 2,3-Dihydro-2,2-dimethyl-7-benzofuranyl Ester	C11-A032
Carbamic Acid, 3,5-Dimethyl-4-methylthiophenyl Ester, N-Methyl	C11-A106
Carbamic Acid, Dimethyl-, m-(Diethylmethylamino)phenyl Ester, Iodide	C02-A050
Carbamic Acid, Methyl-, 2-(1-Methylethoxy)phenyl Ester	C11-A143
Carbamic Acid, Methyl-, 2,2-dimethyl-2,3-dihydro-7-benzofuranyl Ester	C11-A032
Carbamic Acid, Methyl-, 2,2-Dimethyl-2,3-dihydrobenzofuran-7-yl Ester	C11-A032
Carbamic Acid, Methyl-, 2,3-(Dimethylmethylenedioxy)phenyl Ester	C11-A014
Carbamic Acid, Methyl-, 2,3-(Isopropylidenedioxy)phenyl Ester	C11-A014
Carbamic Acid, Methyl-, 3,5-Dimethyl-4-(methylthio)phenyl Ester	C11-A106
Carbamic Acid, Methyl-, 4-(Methylthio)-3,5-xylyl Ester	C11-A106
Carbamic Acid, Methyl-, m-(Diethylmethylammonio)phenyl Ester, Chloride	C02-A051
Carbamic Acid, Methyl-, O-[[[(Dimethylcarbamoyl)methylthio]methylene]amino] Derivative	C11-A147
Carbamic Acid, Methyl-, o-Isopropoxyphenyl Ester	C11-A143
Carbamic Acid, Methyl-, ortho-Isopropoxyphenyl Ester	C11-A143
Carbamic Acid, N,N-Dimethyl-, 3-Diethylaminophenyl Ester, Methiodide	C02-A050
Carbamic Acid, N,N-Dimethyl, Chloride	C02-C052
Carbamic Acid, N-Methyl-, 3-Diethylaminophenyl Ester, Methochloride	C02-A051
Carbamic Acid, N-Methyl-,3-Dimethylaminophenyl Ester, Methochloride	C02-A051
Carbamic Chloride, Dimethyl-	C02-C052
Carbamoyl Chloride, Dimethyl-	C02-C052
Carbamyl	C11-A003
Carbamyl Chloride, N,N-Dimethyl-	C02-C052
Carbicron	C11-A056
Carbinamine	C11-A109
Carbodan	C11-A032
Carbodiimide, Dicyclohexyl-	C01-C056
Carbodiimide, Diisopropyl-	C01-C058

(*Continued*)

Carboethoxy Chloride	C11-A066
Carbofenothion	C11-A036
Carbofenotion	C11-A036
Carbofenotionum	C11-A036
Carbofenthion	C11-A036
Carbofurane	C11-A032
Carbomicron	C11-A056
Carbon Bichloride	C11-A136
Carbon Bisulfide	C11-A033
Carbon Bisulfuret	C11-A033
Carbon Bisulphide	C11-A033
Carbon Dichloride	C11-A136
Carbon Dichloride Oxide	C10-A003
Carbon Difluoride Oxide	C11-A034
Carbon Disulfide	C11-A033
Carbon Disulphide	C11-A033
Carbon Fluoride Oxide	C11-A034
Carbon Hydride Nitride	C07-A001
Carbon Monoxide	C09-A001
Carbon Monoxide Monosulfide	C11-A035
Carbon Nitride	C07-A005
Carbon Oxide	C09-A001
Carbon Oxide Sulfide	C11-A035
Carbon Oxide Sulphide	C11-A035
Carbon Oxychloride	C10-A003
Carbon Oxyfluoride	C11-A034
Carbon Oxysulfide	C11-A035
Carbon Sulfide	C11-A033
Carbon Sulphide	C11-A033
Carbon Tetrachlorosulfide	C10-A014
Carbon Tetrachlorosulphide	C10-A014
Carbon Tetrachlorsulfide	C10-A014
Carbon Tetrachlorsulphide	C10-A014
Carbon-bromine	C11-A110
Carbone	C09-A001
Carbone (Oxychlorure de)	C10-A003
Carbone (Oxyde de)	C09-A001
Carbone (Sulfure de)	C11-A033
Carbonic Acid Dichloride	C10-A003
Carbonic Acid, Bis(trichloromethyl) Ester	C10-A005
Carbonic Chloride	C10-A003
Carbonic Dichloride	C10-A003
Carbonic Dichloride, (Phenylimino)-	C10-A013
Carbonic Difluoride	C11-A034
Carbonic Oxide	C09-A001
Carbonimidic Chloride Fluoride, [(Bromoethoxyphosphinyl)oxy]-	C01-C122
Carbonimidic Chloride Fluoride, [(Chloroethoxyphosphinyl)oxy]-	C01-C123
Carbonimidic Chloride Fluoride, [(Chloromethoxyphosphinyl)oxy]-	C01-C115
Carbonimidic Chloride Fluoride, [(Chloropropoxyphosphinyl)oxy]-	C01-C130
Carbonimidic Chloride Fluoride, [(Dibromophosphinyl)oxy]-	C01-C109

Carbonimidic Chloride Fluoride, [(Dichlorophosphinyl)oxy]- C01-C111
Carbonimidic Chloride Fluoride, [(Ethoxyfluorophosphinyl)oxy]- C01-A046
Carbonimidic Chloride Fluoride, [(Fluoromethoxyphosphinyl)oxy]- C01-A042
Carbonimidic Chloride Fluoride, [[(2-Chloro-1-methylethoxy)fluorophosphinyl]oxy]- C01-A050
Carbonimidic Chloride Fluoride, [[(2-Chloro-1-methylpropoxy)fluorophosphinyl]oxy]- C01-A051
Carbonimidic Chloride Fluoride, [[(2-Chloroethoxy)fluorohydroxyphosphinyl]oxy]- C01-A049
Carbonimidic Chloride Fluoride, [[Chloro(1-methylethoxy)phosphinyl]oxy]- C01-C129
Carbonimidic Dibromide, Hydroxy- C05-A002
Carbonimidic Dichloride, [(Chloromethoxyphosphinyl)oxy]- C01-C117
Carbonimidic Dichloride, [(Chloropropoxyphosphinyl)oxy]- C01-C135
Carbonimidic Dichloride, [(Dichlorophosphinyl)oxy]- C01-C112
Carbonimidic Dichloride, [(Ethoxyfluorophosphinyl)oxy]- C01-A045
Carbonimidic Dichloride, [(Fluoromethoxyphosphinyl)oxy]- C01-A041
Carbonimidic Dichloride, Hydroxy- C05-A001
Carbonimidic Dichloride, N-Phenyl- C10-A013
Carbonimidic Dichloride, Phenyl- C10-A013
Carbonimidic Difluoride, [(Chloroethoxyphosphinyl)oxy]- C01-C126
Carbonimidic Difluoride, [(Chloromethoxyphosphinyl)oxy]- C01-C118
Carbonimidic Difluoride, [(Chloropropoxyphosphinyl)oxy]- C01-C136
Carbonimidic Difluoride, [(Dichlorophosphinyl)oxy]- C01-C110
Carbonimidic Difluoride, [(Ethoxyfluorophosphinyl)oxy]- C01-A047
Carbonimidic Difluoride, [(Fluoromethoxyphosphinyl)oxy]- C01-A043
Carbonimidic Diiodide, Hydroxy- C05-A003
Carbonio C09-A001
Carbonio (Ossiclorure di) C10-A003
Carbonio (Ossicloruro di) C10-A003
Carbonio (Ossido di) C09-A001
Carbonio (Solfuro di) C11-A033
Carbonochloride Acid, 1-Methylethyl Ester C11-A093
Carbonochloridic Acid 1-Methylethyl Ester C11-A093
Carbonochloridic Acid Butan-2-yl Ester C11-A027
Carbonochloridic Acid Propan-2-yl Ester C11-A093
Carbonochloridic Acid Propyl Ester C11-A144
Carbonochloridic Acid Trichloromethyl Ester C10-A004
Carbonochloridic Acid, 1-Methylpropyl Ester C11-A027
Carbonochloridic Acid, 2-Methylpropyl Ester C11-A092
Carbonochloridic Acid, 2-Propen-1-yl Ester C11-A006
Carbonochloridic Acid, 2-Propenyl Ester C11-A006
Carbonochloridic Acid, Butyl Ester C11-A026
Carbonochloridic Acid, Ethyl Ester C11-A066
Carbonochloridic Acid, Methyl Ester C11-A111
Carbonochloridothioic Acid, S-Ethyl Ester C11-A067
Carbononitridic Bromide C07-A002
Carbononitridic Chloride C07-A003
Carbononitridic Iodide C07-A004
Carbonyl Chloride C10-A003
Carbonyl Dichloride C10-A003
Carbonyl Difluoride C11-A034
Carbonyl Fluoride C11-A034

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Carbonyl Nickel	C09-A003
Carbonyl Oxyfluoride	C11-A034
Carbonyl Sulfide	C11-A035
Carbonyl Sulphide	C11-A035
Carbonylchlorid	C10-A003
Carbonylchloride	C10-A003
Carbophenothion	C11-A036
Carbospol	C11-A007
Carfene	C11-A013
Carnelron	C11-A038
Caryolysine	C03-A017
Caryolysine Hydrochloride	C03-A017
Cathyl Chloride	C11-A066
Caustic Arsenic Chloride	C04-C006
Caustic Oil of Arsenic	C04-C006
Cavi-Trol	C01-C077
CB	C07-A002
CB1	C03-A001
CB2	C03-A001
CB3	C04-A002
CB4	C03-A005
CB5	C03-A016
CBN CB4364157	C11-A039
CBR {Phosgene (50%) and Arsenic Trichloride (50%) Mixture}	C10-A
CBR I {Phosgene (50%) and Arsenic Trichloride (50%) Mixture}	C10-A
CC	C07-A003
CC1	C10-A003
CC2	C10-A001
CE {Cyanogen Bromide (25%), Bromoacetone (25%) and Benzene (50%) Mixture}	C07-A
Cekuforatox	C11-A138
Cekumethion	C11-A120
Cekuquat	C11-A132
Cekusan	C11-A055
Cekusil	C11-A137
Cekusil Universal A	C11-A108
Cela S 2225	C11-A025
Celfume	C11-A110
Cellon	C11-A165
Celmer	C11-A137
Celmide	C11-A069
Celphide {Aluminum Phosphide}	C11-A139
Celphos {Aluminum Phosphide}	C11-A139
Ceresan	C11-A073
Ceresol	C11-A137
Certan	C11-A106
Certox	C11-A159
Červená Dýmavá Kyselina Dusičná	C11-A126
CE-Stoff	C07-A002
Cethion	C11-A065
CFC 11	C11-A081

CFE	C11-A177
CFV	C11-A037
CG	C10-A003
CG1750000	C04-C006
CG2275000	C11-A011
CG3325000	C11-A012
CG3675000	C11-A151
CG6475000	C08-A001
CGI 1700	C01-C087
CH2975000	C04-A002
CH3500000	C04-A001
CH4375000	C04-A003
CH5425000	C04-A004
CHA	C11-A048
Checkmate	C01-C077
Chem Pels C	C11-A151
Chemagro 37289	C11-A075
Chemical Blister Gas No. 1	C03-A001
Chemical Blister Gas No. 2	C03-A001
Chemical Blister Gas No. 3	C04-A002
Chemical Blister Gas No. 4	C03-A005
Chemical Blister Gas No. 5	C03-A016
Chemical Choking Gas No. 1	C10-A003
Chemical Choking Gas No. 2	C10-A001
Chemical Nerve Gas No. 1	C01-A002
Chemical Nerve Gas No. 2	C07-A001
Chemical Nerve Gas No. 3	C07-A003
Chemical Nerve Gas No. 4	C01-A001
Chemical Screening Smoke No. 5	C11-A172
Chemifluor	C01-C077
Chem-penta	C11-A134
Chem-Sen 56	C11-A151
Chem-tol	C11-A134
Chevron 9006	C11-A103
ChiBi	C07-A001
Chinese VX	C01-A
Chinufur	C11-A032
Chipman 6199	C01-A014
Chipman 6200	C01-A014
Chipman R-6199	C01-A014
Chladone 11	C11-A081
Chlofenvinphos	C11-A037
Chlon	C11-A134
Chloor	C10-A001
Chlooretheen	C11-A180
Chloorpikrine	C10-A006
Chloortrifluoretheen	C11-A177
Chloortrifluorethyleen	C11-A177
Chloorwaterstof	C11-A088

(*Continued*)

Chlor	C10-A001
Chlor(methyl)silan	C11-A112
Chlor(VII)-säure	C11-A135
Chloracetaldehyde	C11-A040
Chloracetonitrile	C11-A041
Chloracetyl Chloride	C11-A042
Chloral	C10-A003
Chlorameisensaeure Methylester	C11-A111
Chlorameisensaeureaethylester	C11-A066
Chlorameisensäureisopropylester	C11-A093
Chloramine	C03-A017
Chloramine (Nitrogen Mustard)	C03-A017
Chloran	C11-A088
Chlorane	C11-A088
Chloranesulfonic Acid	C11-A045
Chlorcyan	C07-A003
Chlorcyanomethan	C11-A041
Chlordimethylether	C11-A044
Chlore	C10-A001
Chlorek 2,2-Dichloro-N-[(chloroetoksyfosfinylo)oksy]etanoimidoilu	C01-C128
Chlorek 2,2-Dichloro-N-[(dichlorofosfinylo)oksy]etanoimidoilu	C01-C119
Chlorek 2-Chloro-N-[(chloroetoksyfosfinylo)oksy]etanoimidoilu	C01-C134
Chlorek 2-Chloro-N-[(chlorometoksyfosfinylo)oksy]etanoimidoilu	C01-C125
Chlorek 2-Chloro-N-[(dichlorofosfinylo)oksy]etanoimidoilu	C01-C114
Chlorek 2-Chloro-N-{[chloro-(2,2,3,3-tetrafluoropropoksy)fosfinylo]oksy}etanoimidoilu	C01-C142
Chlorek Fluorek [(2-Chloro-1-metylopropylofosfinylo)oksy]karbonoimidowy	C01-C143
Chlorek Fluorek [(Bromoetoksyfosfinylo)oksy]karbonoimidowy	C01-C122
Chlorek Fluorek [(Chloro-2-chloroetoksyfosfinylo)oksy]karbonoimidowy	C01-C121
Chlorek Fluorek [(Chloroetoksyfosfinylo)oksy]karbonoimdowy	C01-C123
Chlorek Fluorek [(Chloroizopropylofosfinylo)oksy]karbonoimidowy	C01-C129
Chlorek Fluorek [(Chlorometoksyfosfinylo)oksy]karbonoimidowy	C01-C115
Chlorek Fluorek [(Chloropropylofosfinylo)oksy]karbonoimidowy	C01-C130
Chlorek Fluorek [(Dibromofosfinylo)oksy]karbonoimidowy	C01-C109
Chlorek Fluorek [(Dichlorofosfinylo)oksy]karbonoimidowy	C01-C111
Chlorek Fluorek [(Etoksyfluorofosfinylo)oksy]karbonoimidowy	C01-A046
Chlorek Fluorek [(Fluorometoksyfosfinylo)oksy]karbonoimidowy	C01-A042
Chlorek Fluorek {[(2-Chloro-1-metyloetoksy)fluorofosfinylo]oksy}karbonoimidowy	C01-A050
Chlorek Fluorek {[(2-Chloro-1-metylopropoksy)fluorofosfinylo]oksy}karbonoimidowy	C01-A051
Chlorek Fluorek {[(2-Chloroetoksy)fluorofosfinylo]oksy}karbonoimidowy	C01-A049
Chlorek N-[(Chloroetoksyfosfinylo)oksy]-2-metylopropanoimidoilu	C01-C147
Chlorek N-[(Chloroetoksyfosfinylo)oksy]etanoimidoilu	C01-C138
Chlorek N-[(Chloroetoksyfosfinylo)oksy]propanoimidoilu	C01-C141
Chlorek N-[(Chloropropoksyfosfinylo)oksy]-2-metylopropanoimidoilu	C01-C152
Chlorek N-[(Chloropropoksyfosfinylo)oksy]butanoimidoilu	C01-C148
Chlorek N-[(Chloropropoksyfosfinylo)oksy]etanoimidoilu	C01-C139
Chlorek N-[(Chloropropoksyfosfinylo)oksy]propanoimidoilu	C01-C146
Chlorek N-[(Dichlorofosfinylo)oksy]-2-metylopropanoimidoilu	C01-C131
Chlorek N-[(Dichlorofosfinylo)oksy]butanoimidoilu	C01-C132
Chlorek N-[(Dichlorofosfinylo)oksy]etanoimidoilu	C01-C116
Chlorek N-[(Dichlorofosfinylo)oksy]propanoimidoilu	C01-C124

Chlorek N-{[Chloro-(1-metyloetoksy)fosfinylo]oksy}-2-metylopropanoimidoilu	C01-C151
Chlorek N-{[Chloro-(1-metyloetoksy)fosfinylo]oksy}butanoimidoilu	C01-C150
Chlorek N-{[Chloro-(1-metyloetoksy)fosfinylo]oksy}etanoimidoilu	C01-C140
Chlorek N-{[Chloro-(1-metyloetoksy)fosfinylo]oksy}propanoimidoilu	C01-C144
Chlorek N-{[Chloro-(2-metylopropoksy)fosfinylo]oksy}-2-metylopropanoimidoilu	C01-C154
Chlorek N-{[Chloro-(2-metylopropoksy)fosfinylo]oksy}butanoimidoilu	C01-C153
Chlorek N-{[Chloro-(2-metylopropoksy)fosfinylo]oksy}etanoimidoilu	C01-C145
Chlorek N-{[Chloro-(2-metylopropoksy)fosfinylo]oksy}propanoimidoilu	C01-C149
Chlorek Rtęci(II)	C11-A096
Chlorek Sulfurylu	C11-A158
Chlorek Winylu	C11-A180
Chloressigsäurenitril	C11-A041
Chlorethamine	C03-A017
Chlorethannitril	C11-A041
Chlorethazine	C03-A017
Chlorethene	C11-A180
Chlorethylene	C11-A180
Chlorex	C11-A017
Chlorfenvinfos	C11-A037
Chlorfenvinphos	C11-A037
Chlorform	C11-A043
Chloric(VII) Acid	C11-A135
Chlorid Kremicity	C11-A166
Chlorid Kyseliny Chloroctove	C11-A042
Chlorid Kyseliny Dimethylkarbaminove	C02-C052
Chlorid Rtutnaty	C11-A096
Chlorid Sulfurylu	C11-A158
Chloride of Phosphorus	C01-C081
Chloride of Sulfur	C03-C038
Chloride of Sulfur	C03-C039
Chloride of Sulphur	C03-C039
Chlorido(ethyl)mercury	C11-A073
Chloridocarbonic Acid s-Butyl Ester	C11-A027
Chloridocarbonic Acid sec-Butyl Ester	C11-A027
Chloridocarbonic Acid secondary-Butyl Ester	C11-A027
Chloridohydrogen	C11-A088
Chloridophosphorous Acid Diethyl	C01-C159
Chloridosulfuric Acid	C11-A045
Chloridric Acid	C11-A088
Chlorine	C10-A001
Chlorine Bromide	C11-A021
Chlorine Cyanide	C07-A003
Chlorine Dioxide	C11-A038
Chlorine Fluoride	C10-A015
Chlorine Fluoride	C11-A039
Chlorine Molecule	C10-A001
Chlorine Oxide	C11-A038
Chlorine Peroxide	C11-A038
Chlorine Sulfide	C03-C039

(*Continued*)

Chlorine Sulphide	C03-C039
Chlorine Tetraoxide	C11-A135
Chlorine Trifluoride	C10-A015
Chlorine(IV) Oxide	C11-A038
Chlorinefluoride	C11-A039
Chlorinum	C10-A001
Chlormethine	C03-A017
Chlormethine Hydrochloride	C03-A017
Chlormethinum	C03-A017
Chlormethyl Methyl Ether	C11-A044
Chlormethylcyanid	C11-A041
Chloro Acetylchlorid	C11-A042
Chloro Formic Acid Methyl Ester	C11-A111
Chloro Ketone	C10-A003
Chloro Methyl Sulfone	C11-A104
Chloro Methyl Sulphone	C11-A104
Chloro Methylether	C10-A011
Chloro Thiohypochlorite	C03-C039
Chloro(chloromethoxy) Methane	C10-A011
Chloro(diethoxy)phosphane	C01-C159
Chloro(dimethylamino)ethane	C01-C099
Chloro(dimethylamino)ethane Hydrochloride	C01-C099
Chloro(ethoxy)methanone	C11-A066
Chloro(ethyl)mercury	C11-A073
Chloro(methoxy)methane	C11-A044
Chloro(methoxy)methanone	C11-A111
Chloro(methyl)silane	C11-A112
Chloro(methyl)silicon	C11-A112
Chloro(methyloxy)methane	C11-A044
Chloro(propan-2-yloxy)methanone	C11-A093
Chloro-2(beta-chloroethoxy)ethane	C11-A017
Chloro-2(β-chloroethoxy)ethane	C11-A017
Chloroacetalaldehyde	C11-A040
Chloroacetaldehyde	C11-A040
Chloroacetaldehyde Monomer	C11-A040
Chloroacethyl Chloride	C11-A042
Chloroacetic Acid Chloride	C11-A042
Chloroacetic Chloride	C11-A042
Chloroacetoaldehyde	C11-A040
Chloroacetonitrile	C11-A041
Chloroacetyl Choride	C11-A042
Chloroacetylchlonde	C11-A042
Chloroacetylchlorid	C11-A042
Chloroactaldehyde	C11-A040
Chloroactyl Chloride	C11-A042
Chloroaldehyde	C11-A040
Chlorobromine	C11-A021
Chlorocarbonate D'ethyle	C11-A066
Chlorocarbonate de Methyle	C11-A111
Chlorocarbonic Acid Ethyl Ester	C11-A066

Chlorocarbonic Acid Isobutyl Ester	C11-A092
Chlorocarbonic Acid Isopropyl Ester	C11-A093
Chlorocarbonic Acid Methyl Ester	C11-A111
Chlorocarbonic Acid n-Butyl Ester	C11-A026
Chlorocarbonic Acid normal-Butyl Ester	C11-A026
Chlorocarbonic Methyl Ester	C11-A111
Chlorocyan	C07-A003
Chlorocyanide	C07-A003
Chlorocyanogen	C07-A003
Chlorocyanomethane	C11-A041
Chlorodiethoxyphosphine	C01-C159
Chlorodiethyl Phosphite	C01-C159
Chlorodimethyl Ether	C11-A044
Chloroeten	C11-A180
Chloroethanal	C11-A040
Chloroethanenitrile	C11-A041
Chloroethanol	C03-C041
Chloroethanoyl Chloride	C11-A042
Chloroethene	C11-A180
Chloroethyl Ether	C11-A017
Chloroethyldimethylamine Hydrochloride	C01-C099
Chloroethylene	C11-A180
Chloroethyl-Mercur	C11-A073
Chloroethylmercury	C11-A073
Chloroethylowy Alkohol	C03-C041
Chlorofenvinphos	C11-A037
Chlorofluoromethane	C11-A081
Chloroform	C11-A043
Chloroform, Nitro-	C10-A006
Chloroformiate de Methyle	C11-A111
Chloroformic Acid Allyl	C11-A006
Chloroformic Acid Allyl Ester	C11-A006
Chloroformic Acid Butyl Ester	C11-A026
Chloroformic Acid Dimethylamide	C02-C052
Chloroformic Acid Ethyl Ester	C11-A066
Chloroformic Acid Isobutyl Ester	C11-A092
Chloroformic Acid Isopropyl	C11-A093
Chloroformic Acid Isopropyl Ester	C11-A093
Chloroformic Acid Methyl Ester	C11-A111
Chloroformic Acid n-Butyl Ester	C11-A026
Chloroformic Acid normal-Butyl Ester	C11-A026
Chloroformic Acid Propyl Ester	C11-A144
Chloroformic Acid s-Butyl Ester	C11-A027
Chloroformic Acid sec-Butyl Ester	C11-A027
Chloroformic Acid Trichloromethyl Ester	C10-A004
Chloroformyl Chloride	C10-A003
Chlorohydric Acid	C11-A088
Chloroketone	C10-A003
Chlorométhanoate de Méthyle,	C11-A111

(*Continued*)

Chloromethyl Cyanide	C11-A041
Chloromethyl Ether	C10-A011
Chloromethyl Ether	C11-A044
Chloromethylm Ethyl Ether	C11-A044
Chloro-N,N-Dimethylamide	C02-C052
Chloroniumchlorid	C10-A001
Chloroperoxyl	C11-A038
Chlorophen	C11-A134
Chlorophenasic Acid	C11-A134
Chloropicrin	C10-A006
Chloropicrina	C10-A006
Chloropicrine	C10-A006
Chlorosarin	C01-C054
Chloroschwefelsaeure-aethylester	C10-A010
Chlorosiarczan Etylu	C10-A010
Chlorosiarczan Metylu	C10-A009
Chlorosoman	C01-C055
Chlorosufonic Acid	C11-A045
Chlorosulfane	C03-C038
Chlorosulfenyl Chloride	C03-C039
Chlorosulfone	C11-A158
Chlorosulfonic Acid	C11-A045
Chlorosulfonic Acid Ethylester	C10-A010
Chlorosulfonium Chloride	C03-C039
Chlorosulfonyl Chloride	C11-A158
Chlorosulfonyloxyethane	C10-A010
Chlorosulfonyloxymethane	C10-A009
Chlorosulfuric Acid	C11-A045
Chlorosulfuric Acid Ethyl Ester	C10-A010
Chlorosulfuric Acid Methyl Ester	C10-A009
Chlorosulphane	C03-C038
Chlorosulphone	C11-A158
Chlorosulphonic Acid	C11-A045
Chlorosulphuric Acid	C11-A045
Chlorosyloxidanyl	C11-A038
Chlorothio(trichloromethyl)	C10-A014
Chlorothioformic Acid S-Ethyl Ester	C11-A067
Chlorotrifluorethylene	C11-A177
Chlorotrifluoride	C10-A015
Chlorotrifluoroethylene	C11-A177
Chlorotrifluoroetylene	C11-A177
Chlorovinyl Dichloroarsine	C04-A002
Chlorovinylarsine Dichloride	C04-A002
Chlorovinylarsinedichloride	C04-A002
Chlorovodík	C11-A088
Chlorowodor	C11-A088
Chlorowodór	C11-A088
Chlorphenvinfos	C11-A037
Chlorphenvinphos	C11-A037
Chlorpicrin	C10-A006

Chlorpikrin	C10-A006
Chlorschwefel	C03-C038
Chlorsulfonsaureathylester	C10-A010
Chlorsulphonic Acid	C11-A045
Chlorthiepin	C11-A063
Chlorthioameisensaeure-S-ethylester	C11-A067
Chlortiepin	C11-A063
Chlortrifluoraethylen	C11-A177
Chlortrifluorethen	C11-A177
Chlortrifluorethylen	C11-A177
Chlorue de Methallyle	C11-A102
Chlorure Arsenieux	C04-C006
Chlorure D'arsenic	C04-C006
Chlorure D'ethylene	C11-A070
Chlorure D'hydrogene	C11-A088
Chlorure D'hydrogene Anhydre	C11-A088
Chlorure de Bore	C11-A020
Chlorure de Chloracetyle	C11-A042
Chlorure de Cyanogene	C07-A003
Chlorure de Mercure(II)	C11-A096
Chlorure de Mésyle	C11-A104
Chlorure de Methallyle	C11-A102
Chlorure de Méthanesulfonyle	C11-A104
Chlorure de Phenylcarbyl-amine	C10-A013
Chlorure de Silicium	C11-A166
Chlorure de Sulfuryle	C11-A158
Chlorure de Vinyle	C11-A180
Chlorure Mercurique	C11-A096
Chlorure Sulfurique	C11-A158
Chloruro de Hidrogene	C11-A088
Chloruro de Hidrogeno	C11-A088
Chloruro de Hidrogeno Anhidro	C11-A088
Chlorvinphos	C11-A055
Chlorwasserstoff	C11-A088
CHMPA	C01-C072
Choking Gas No. 1	C10-A003
Choking Gas No. 2	C10-A001
Choroacetyl Chloride	C11-A042
Chorosulfonic Acid	C11-A045
Chumbo Tetraetila	C11-A168
Cianeto de Etila	C11-A142
Cianógeno Chlorido	C07-A003
Cianopropeno	C11-A101
Cianurina	C11-A100
Cianuro di Etile	C11-A142
Cianuro di Mercurio(II)	C11-A100
Cianuro di sodio	C07-C009
Cianuro di Vinile	C11-A002
Cianuro Mercurico	C11-A100

(*Continued*)

Ciazinon	C11-A051
Ciba-Geigy 9138	C11-A071
Cici	C10-A011
Ciclopentimina	C11-A141
Cis-1-methyl-2-methyl Carbamoyl Vinyl Phosphate	C11-A125
cis-2-Butenal	C11-A047
cis-2-Butenaldehyde	C11-A047
Cis-2-Chlorovinyldichloroarsine	C04-A002
cis-2-Dimethylcarbamoyl-1-methylvinyl Dimethylphosphate	C11-A056
cis-But-2-enal	C11-A047
cis-Crotonal	C11-A047
cis-Crotonaldehyde	C11-A047
Cislin	C11-A049
Citram	C01-A014
Citrine Ointment	C11-A097
CK	C07-A003
CL	C10-A001
Clairsit	C10-A014
Clairsite	C10-A014
Claudelite	C11-A012
Clhorameisensaeureaethylester	C11-A066
Cl-M2B45-Cl	C01-C066
Clocat F	C01-C076
Clofenvineosum	C11-A037
Clofenvinfos	C11-A037
Clofenvinphos	C11-A037
Cloramin	C03-A017
Cloreto de Mercúrio(II)	C11-A096
Cloreto de Silício (IV)	C11-A166
Cloreto de Sulfonila	C11-A158
Cloreto de Sulfurila	C11-A158
Cloreto de Titânio (IV)	C11-A172
Cloreto de Vinila	C11-A180
Cloreto Mercúrico	C11-A096
Cloreto Sulfúrico	C11-A158
Clorex	C11-A017
Clorine	C10-A001
Cloro	C10-A001
Cloroetene	C11-A180
Cloroeteno	C11-A180
Cloroetileno	C11-A180
Cloroform	C11-A043
Cloroformiato de Etilo	C11-A066
Cloroformio	C11-A043
Cloropicrina	C10-A006
Clorură de Sulfonil	C11-A158
Clorură de Sulfuril	C11-A158
Clorură de Titan (IV)	C11-A172
Clorură de Vinil	C11-A180
Cloruro de Hidrogeno	C11-A088

Cloruro de Hidrogeno Anhidro	C11-A088
Cloruro de Hidrogeno Anhydro	C11-A088
Cloruro de Isobutenilo	C11-A102
Cloruro de Mercurio (II)	C11-A096
Cloruro de Mesilo	C11-A104
Cloruro de Metalilo	C11-A102
Cloruro de Metansulfonilo	C11-A104
Cloruro de Óxido de Azufre	C11-A158
Cloruro de Silicio (IV)	C11-A166
Cloruro de Sulfonilo	C11-A158
Cloruro de Sulfurilo	C11-A158
Cloruro de Titanio (IV)	C11-A172
Cloruro de Vinilo	C11-A180
Cloruro di Ethene	C11-A070
Cloruro di Mercurio	C11-A096
Cloruro di Metallile	C11-A102
Cloruro di Metilformiato	C11-A111
Cloruro di Metilmetanoato	C11-A111
Cloruro di Solforile	C11-A158
Cloruro di Vinile	C11-A180
Cloruro Mercurico	C11-A096
Cloruro Solforico	C11-A158
Cloruro Titanic	C11-A172
C-Lost {Various Vesicants and Silicon Oil Mixture}	C03-A
Club	C11-A106
CM {Phosgene (60%) and Arsenic Trichloride (40%) Mixture}	C10-A
CMDP	C11-A123
CME	C10-A011
CMME	C11-A044
CMP	C11-A102
CMPA	C01-C072
CMPF	C01-A005
CN1	C01-A002
CN2	C07-A001
CN3	C07-A003
CN4	C01-A001
CO {Phosgene (75-66%) and Stannic Chloride (25-33%) Mixture}	C10-A003
Colliane	C11-A083
Colloidal-S	C01-C061
Collongiane {Formaldehyde and Ammonia Mixture}	C11-A083
Collongite	C10-A003
Collongite	C10-A003
Collongite {Phosgene (60%) and Arsenic Trichloride (40%) Mixture}	C10-A
Collongite {Phosgene (75-66%) and Stannic Chloride (25-33%) Mixture}	C10-A003
Collongite Mixture {Phosgene (50%) and Arsenic Trichloride (50%) Mixture}	C10-A
Collongite Opacite {Phosgene and Stannic Chloride Mixture}	C10-A003
Combat Gas	C10-A003
Compass	C11-A051
Compd1080	C11-A152

(*Continued*)

Composites {Lewisite 1, Lewisite 2, Lewisite 3 and Arsenic Trichloride Mixtures}	C04-C
Composto 1080	C11-A152
Compound 1080	C11-A152
Compound 1081	C11-A077
Compound 1120	C10-A016
Compound 1861	C11-A008
Compound 2046	C11-A123
Compound 3422	C11-A133
Compound 4072	C11-A037
Compound A	C11-A039
Compound A4	C01-D177
Compound Z	C10-A016
Compuesto 1080	C11-A152
Co-Nav	C11-A061
Contact Acid	C11-A157
Contra Creme	C11-A137
Contraven	C11-A163
Copper Acetate Arsenite	C11-A046
Copper Acetoarsenite	C11-A046
Copper(II) Acetate Meta-arsenite	C11-A046
Copper(II) Acetoarsenite	C11-A046
Copper, Bis(acetato)hexametaarsenitotetra-	C11-A046
Corophos	C11-A125
Corosul D and S	C01-C061
Corothion	C11-A133
Corrosive Mercury Chloride	C11-A096
Corrosive Sublimate	C11-A096
Corthion	C11-A133
Corthione	C11-A133
Cosan	C01-C061
Cosan PMA	C11-A137
Cosmic	C11-A035
Cotneon	C11-A013
Cotnion	C11-A013
Cotnion-Methyl	C11-A013
Counter	C11-A163
Crackdown	C11-A049
CRC	C11-A096
Credo	C01-C077
Cresorcinol Diisocyanate	C11-A173
Criptodin	C11-A073
Crisfuran	C11-A032
Crisodin	C11-A125
Crisodrin	C11-A125
Crisquat	C11-A132
Crisulfan	C11-A063
Crotonal	C11-A047
Crotonaldehyde	C11-A047
Crotonaldehyde, (E)-	C11-A047
Crotonaldehyde, (Z)-	C11-A047

Crotonamide, 3-Hydroxy-N,N-dimethyl-, cis-, Dimethyl Phosphate	C11-A056
Crotonamide, 3-Hydroxy-N-methyl-, Dimethylphosphate, (E)-	C11-A125
Crotonamide, 3-Hydroxy-N-methyl-, Dimethylphosphate, Cis-	C11-A125
Crotonamide, 3-Hydroxy-N-N-dimethyl-, Dimethyl Phosphate, (E)-	C11-A056
Crotonamide, 3-Hydroxy-N-N-dimethyl-, Dimethyl Phosphate, cis-	C11-A056
Crotonic Acid, 3-Hydroxy-, Methyl ester, Dimethyl Phosphate	C11-A123
Crotonic Aldehyde	C11-A047
Crotos	C11-A125
Crotylaldehyde	C11-A047
Cryptodine	C11-A073
Crystex	C01-C061
Crysthion	C11-A013
Crysthyon	C11-A013
CS-0008466	C01-C058
CS5	C11-A172
CSA	C11-A045
C-Stoff	C10-A009
CTFE	C11-A177
Cudgel	C11-A082
Cupric Acetoarsenite	C11-A046
Curafume	C11-A110
Curaterr	C11-A032
Curaterr 5	C11-A032
CVAO	C04-D008
CVD	C04-A002
CVM	C11-A180
CVP	C11-A037
CVX	C01-A
CX	C05-A001
CY	C04-A001
Cyaanwaterstof	C07-A001
Cyanasalt H	C07-C009
Cyanasalt S	C07-C009
Cyanater	C11-A163
Cyanhydrine D'acetone	C11-A001
Cyanide Bromide	C07-A002
Cyanide Chloride	C07-A003
Cyanide of Calcium	C07-C007
Cyanide of Potassium	C07-C008
Cyanide of Sodium	C07-C009
Cyano(methylmercuri)guanidine	C11-A119
Cyanobrik	C07-C009
Cyanobromide	C07-A002
Cyanochloride	C07-A003
Cyanodimethylaminoethoxyphosphine	C01-A001
Cyanoethane	C11-A142
Cyanoethene	C11-A002
Cyanoethylene	C11-A002
Cyanoethylene	C11-A041

(*Continued*)

Cyanogas	C07-C007
Cyanogen	C07-A005
Cyanogen Bromide	C07-A002
Cyanogen Chloride	C07-A003
Cyanogen Iodide	C07-A004
Cyanogen Monobromide	C07-A002
Cyanogen Monoiodide	C07-A004
Cyanogen, Hydrocyanide	C07-A001
Cyanogen, Monohydrate	C07-A001
Cyanogene	C07-A005
Cyanogran	C07-C009
Cyanohydrin-2-propanone	C11-A001
Cyanomercury	C11-A100
Cyanomethyl Chloride	C11-A041
Cyanomethyl Thioether	C11-A122
Cyano-m-phenoxybenzyl (1 R,3 R)-3-(2,2-Dibromovinyl)-2,2-dimethylcyclopropanecarboxylate	C11-A049
Cyanophos	C11-A055
Cyanopotassium	C07-C008
Cyanure D'éthyle	C11-A142
Cyanure de Calcium	C07-C007
Cyanure de Mercure	C11-A100
Cyanure de Potassium	C07-C008
Cyanure de Sodium	C07-C009
Cyanure de Vinyle	C11-A002
Cyanure de Zinc	C07-C010
Cyanwasserstoff	C07-A001
Cyclodan	C11-A063
Cyclohexaamine, N,N'-Methanetetraylbis-	C01-C056
Cyclohexanamine	C11-A048
Cyclohexanamine, N,N'-Methanetetraylbis-	C01-C056
Cyclohexaneamine	C11-A048
Cyclohexanyl Amine	C11-A048
Cyclohexyl Amine	C11-A048
Cyclohexyl Ester of Methylphosphonofluoridic Acid	C01-A005
Cyclohexyl Hydrogen Methylphosphonate	C01-C072
Cyclohexyl Methylfluorophosphate	C01-A005
Cyclohexyl Methylphosphonate	C01-C072
Cyclohexyl Methylphosphonic Acid	C01-C072
Cyclohexyl Methylphosphonofluoridate	C01-A005
Cyclohexyl Methylphosphonofluoridoate	C01-A005
Cyclohexyl Methylphosphonofluoridothiate	C01-A007
Cyclohexyl S-2-Diethylaminoethyl Methylphosphonothioate	C01-A021
Cyclohexyl S-2-Diethylaminoethyl Methylphosphonothiolate	C01-A021
Cyclohexyl Sarin	C01-A005
Cyclohexylamine	C11-A048
Cyclohexylmethylfluorophosphonate	C01-A005
Cyclohexyloxy(methyl)phosphinic Acid	C01-C072
Cyclohexyloxyfluoromethylphosphine Oxide	C01-A005
Cyclon {Methyl Cyanoformate and Ethyl Cyanoformate Mixture}	C10-A
Cyclone	C11-A132

Cyclone B	C07-A001
Cyclopentadiene Hexachkoride	C11-A085
Cyclopentadiene, Hexachloro-	C11-A085
Cyclopentimine	C11-A141
Cyclopentyl S-(2-Diisopropylaminoethyl) Methylphosphonothioate	C01-A020
Cyclopentyl S-2-Diethylaminoethyl Methylphosphonothioate	C01-A019
Cyclopentyl S-2-Diethylaminoethyl Methylphosphonothiolate	C01-A019
Cyclopentyl S-2-Diisopropylaminoethyl Methylphosphonothiolate	C01-A020
Cyclopropanecarboxylic Acid, 3-((1Z)-2-Chloro-3,3,3-trifluoro-1-propenyl)-2,2-dimethyl-, (2-Methyl (1,1'-biphenyl)-3-yl)methyl Ester, (1 R,3 R)-rel-	C11-A016
Cyclopropanecarboxylic Acid, 3-(2,2-Dibromoethenyl)-2,2-dimethyl-, (S)-cyano(3-phenoxyphenyl) methyl Ester, (1 R,3 R)-	C11-A049
Cyclopropanecarboxylic Acid, 3-(2,2-Dibromoethenyl)-2,2-dimethyl-,(S)-cyano(3-phenoxyphenyl) methyl Ester, (1 R,3 R)-	C11-A049
Cyclopropanecarboxylic Acid, 3-(2-Chloro-3,3,3-trifluoro-1-propenyl)-2,2-dimethyl-, (2-Methyl (1,1'-biphenyl)-3-yl)methyl Ester, (Z)-	C11-A016
Cyclopropanecarboxylic Acid, 3-(2-Chloro-3,3,3-trifluoro-1-propenyl)-2,2-dimethyl-, (2-Methyl [1,1'-biphenyl]-3-yl)methyl Ester, [1α,3α(Z)]-	C11-A016
Cyclopropanecarboxylic Acid, 3-[(1Z)-2-Chloro-3,3,3-trifluoro-1-propen-1-yl]-2,2-dimethyl-, (2-methyl[1,1'-biphenyl]-3-yl)methyl Ester, (1 R,3 R)-	C11-A016
Cyclopropanecarboxylic Acid, 3-[(1Z)-2-Chloro-3,3,3-trifluoro-1-propenyl]-2,2-dimethyl-, (2-Methyl [1,1'-biphenyl]-3-yl)methyl Ester, (1 R,3 R)-	C11-A016
Cyclosarin	C01-A005
Cyclosin	C01-A005
Cyjanowodor	C07-A001
Cylohexylamine	C11-A048
Cymag	C07-C007
Cymag	C07-C009
Cymonic Acid	C11-A078
Cypentil	C11-A141
Cypona	C11-A055
CZ6300000	C11-A173
CZ6310000	C11-A174
Czterochloroetylen	C11-A136
Czteroetylek Olowiu	C11-A168
- D -	
(((Dimethylethyl)thio)methyl) O,O-Diethyl Phosphorodithioate	C11-A163
(DBCP)-EM	C11-A053
(Diethylamino)difluorophosphine Oxide	C01-C071
(Diethylamino)ethanol	C01-C103
(Difluoromethoxy)phosphineoxide {Novichok Precursor}	C01-C
(Diisopropylamino)ethanol	C01-C104
(Dimethylamido)phosphoric Dichloride	C01-C162
(Dimethylamino)Carbonyl Chloride	C02-C052
(Dimethylamino)diethoxyphosphine Oxide	C01-C
(Dimethylamino)phosphonic Dichloride	C01-C162
[(Dibromophosphinyl)oxy]carbonimidic Chloride Fluoride	C01-C109
[(Dichloro)methylsilyl]benzene	C11-A121
[(Dichlorophosphinyl)oxy]carbonimidic Chloride Fluoride	C01-C111

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[(Dichlorophosphinyl)oxy]carbonimidic Dichloride	C01-C112
[(Dichlorophosphinyl)oxy]carbonimidic Difluoride	C01-C110
[DE2]S	C01-D166
[DES]2	C01-D167
D {Sulfur Mustard and Arsine Oil Mixture}	C03-A
D 1410	C11-A147
D Substance	C10-A003
D0254	C01-C058
D1	C03-A016
D4	C01-C162
D7	C01-A001
D-13	C07-A005
D-16	C07-C009
D-25	C11-A012
D-31	C10-A001
Dacutox	C11-A051
Dagadip	C11-A036
Daiflon	C11-A177
Daiflon 11	C11-A081
Daiflon S 1	C11-A081
Dalf	C11-A120
Dalf Dust	C11-A143
Dalfampridine	C11-A008
Daltogen	C03-C045
Danthion	C11-A133
Dash	C11-A055
Dassitox	C11-A051
Dawson 100	C11-A110
Dazzel	C11-A051
DBCP	C11-A053
DBD	C11-A013
DBE	C11-A069
DBFO	C05-A002
DC	C01-C052
DCC	C01-C056
DCCD	C01-C056
DCCDI	C01-C056
DCCI	C01-C056
DCE	C11-A070
DCEE	C11-A017
DCH	C01-C
d-Chloroethanol	C03-C041
DCR 736	C11-A106
DCW	C01-D171
Ddevikol	C11-A055
DDVF	C11-A055
DDVP	C11-A055
DEA	C01-C097
DEA	C03-D060
DEAE	C01-C103

DEAEDEAFP	C01-A032
DEAEDMAFP	C01-A031
Decamethrin	C11-A049
Decamethrine	C11-A049
Decamethylene-(3-hydroxyquinuclidinium Bromide)[(2-Dimethylcarbamoxyethyl) dimethylammonium Bromide]	C02-A013
Decamethylene-(3-hydroxyquinuclidinium Hydrogen Oxalate)[(2-Dimethylcarbamoxyethyl) dimethylammonium Hydrogen Oxalate]	C02-A013
Decamethylene-(3-hydroxyquinuclidinium Hydrogen Sulfate)[(2-Dimethylcarbamoxyethyl) dimethylammonium Hydrogen Sulfate]	C02-A013
Decamethylene-(3-hydroxyquinuclidinium Nirate)[(2-Dimethylcarbamoxyethyl)dimethylammonium Nirate]	C02-A013
Decamethylene-(3-hydroxyquinuclidinium Perchlorate)[(2-Dimethylcarbamoxyethyl) dimethylammonium Perchlorate]	C02-A013
Decamethylene-(3-hydroxyquinuclidinium Tetraphenylboronate)[(2-Dimethylcarbamoxyethyl) dimethylammonium Tetraphenylboronate]	C02-A013
Decis	C11-A049
Decis 2.5ULV	C11-A049
Dedevap	C11-A055
DEEA	C01-C103
DEEP	C01-C090
Degesch	C07-C007
Dehydasal	C01-C103
Dekametrin	C11-A049
Delanov	C11-A061
Delevap	C11-A055
Delicia {Aluminum Phosphide}	C11-A139
Delicia Gastoxin {Aluminum Phosphide}	C11-A139
Delna	C11-A061
Delnatex	C11-A061
Delnav	C11-A061
delta-Chloroethanol	C03-C041
Deltacide	C11-A049
DeltaGard	C11-A049
Deltagran	C11-A049
Deltamethrin	C11-A049
Deltamethrine	C11-A049
Deltametryna	C11-A049
Deltic	C11-A061
Delusal {Zinc Phosphide}	C11-A139
Delzinon	C11-A051
Dema	C03-A017
Demethylfenitrothion	C11-A120
Demeton	C11-A050
Demeton-O	C11-A050
Demeton-S	C11-A050
Demox	C11-A050
DEMP	C01-C089
DEN	C01-C097
Denkavepon	C11-A055

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Denox	C11-A050
DEP	C01-D173
DEPTA	C01-C073
DEPTH	C01-C074
Deriban	C11-A055
Dermaton	C11-A037
Derriban	C11-A055
Derribante	C11-A055
DES	C11-A055
DESA (Prepared by Sulfur Monochloride process)	C03-A001
DESAV (Thickened Sulfur Mustard)	C03-A001
DESH	C01-C105
Desmodur T80	C11-A173
Des-N-methyl Dicrotophos	C11-A125
D-Ester	C03-A001
Destruxol Applex	C01-C106
Destruxol Borer-sol	C11-A070
DeterMite	C11-A016
Detia {Aluminum Phosphide}	C11-A139
Detia Gas Ex-B {Aluminum Phosphide}	C11-A139
Detia Gas Ex-M	C11-A110
Detia-Ex-B {Aluminum Phosphide}	C11-A139
Detiaphos R {Magnesium Phosphide}	C11-A139
DETP	C01-C074
Deutoxide of Nitrogen	C11-A128
Devi	C11-A125
Devikol	C11-A055
Devisulfan	C11-A063
Devisulphan	C11-A063
Devisulphur	C01-C061
Devithion	C11-A120
Dew of Death	C04-A002
Dextrone X	C11-A061
Dexuron	C11-A132
D-Gas	C10-A003
Dhan	C11-A138
DHD (Dusty Sulfur Mustard)	C03-A001
Di(2-(2-Chloroethylthio)ethyl) Ether	C03-A003
Di(2-(beta-Chloroethylthio)ethyl) Ether	C03-A003
Di(2-(β-Chloroethylthio)ethyl) Ether	C03-A003
Di(2-chloroethyl) Ether	C11-A017
Di(2-chloroethyl)methylamine	C03-A017
Di(2-Hydroxyethyl) Sulfide	C03-C037
Di(2-hydroxyethyl)amine	C03-D060
Di(4-isocyanatophenyl)methane	C11-A113
Di(beta-chloroethyl) Ether	C11-A017
Di(beta-hydroxyethyl)amine	C03-D060
Di(beta-hydroxyethyl)ethylene Disulfide	C03-D046
Di(chloroethyl)methylamine	C03-A017
Di(propan-2-yl)methanediimine	C01-C058

Di(thiophosphoric) Acid, Tetraethyl Ester	C11-A161
Di(β-Chloroethyl) Ether	C11-A017
Di(β-hydroxyethyl)amine	C03-D060
Di(β-hydroxyethyl)ethylene Disulfide	C03-D046
Di-2-chloroethyl Ether	C11-A017
Di-2-chloroethyl Sulfide	C03-A001
Di-2-chloroethyl Sulphide	C03-A001
DIAEM	C01-C105
Diaethylamin	C01-C097
Diaethylaminoaethanol	C01-C103
Diafuran	C11-A032
Diagran	C11-A051
Dianon	C11-A051
Diapadrin	C11-A056
Diarsenic Oxide	C11-A012
Diarsenic Pentaoxide	C11-A011
Diarsenic Pentoxide	C11-A011
Diarsenic Trioxide	C11-A012
Diarsonic Trioxide	C11-A012
Diaterr-fos	C11-A051
Diatomic Bromine	C10-A002
Diatomic Chlorine	C10-A001
Diatomic Fluorine	C11-A076
Diazajet	C11-A051
Diazide	C11-A051
Diazinon	C11-A051
Diazitol	C11-A051
Diazol	C11-A051
Diborane	C11-A052
Diborane Hexanhydride	C11-A052
Diborene	C11-A052
Diboron	C11-A052
Diboron Hexahydride	C11-A052
Diboryne	C11-A052
Dibrom Ether	C10-A012
Dibromane	C10-A002
Dibromchlorpropan	C11-A053
Dibromdimethyl Ether	C10-A012
Dibromine	C10-A002
Dibromo(hydroxyimino)methane	C05-A002
Dibromochloropropane	C11-A053
Dibromodimethyl Ether	C10-A012
Dibromoethane	C11-A069
Dibromoethyl Sulfide	C03-A
Dibromoformaldehyde Oxime	C05-A002
Dibromoformaldoxime	C05-A002
Dibromoformoxime	C05-A002
Dibromomethanone Oxime	C05-A002
Dibromomethyl Ether	C10-A012

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Dibromophenylarsine	C04-A005
Dibromure D'ethylene	C11-A069
Dibutoxymethylphosphine Oxide	C01-C092
Dibutyl Methanephosphonate	C01-C092
Dibutyl Methylphosphonate	C01-C092
DIC	C01-C
DIC	C01-C058
DIC Hydrochloride	C01-C
DICDI	C01-C058
Dicétène	C11-A057
Dichlofos	C11-A055
Dichloorvo	C11-A055
Dichlor Amine	C03-A017
Dichlordimethyl Ether	C10-A011
Dichlordimethylaether	C10-A011
Dichlorek [(Chloroizopropylofosfinylo)oksy]karbonoimidowy	C01-C133
Dichlorek [(Chlorometoksyfosfinylo)oksy]karbonoimidowy	C01-C117
Dichlorek [(Chloropropoksyfosfinylo)oksy]karbonoimidowy	C01-C135
Dichlorek [(Dichlorofosfinylo)oksy]karbonoimidowy	C01-C112
Dichlorek [(Etoksyfluorofosfinylo)oksy]karbonoimidowy	C01-A045
Dichlorek [(Fluorometoksyfosfinylo)oksy]karbonoimidowy	C01-A041
Dichlorek 1,1'-Dimetylo-4,4'-bipirydyniowy	C11-A132
Dichloremulsion	C11-A070
Dichloren	C03-A017
Dichloren Hydrochloride	C03-A017
Dichlor-ethylfosfin	C01-C093
Dichlor-fenylarsin	C04-A004
Dichlor-fenyl-methylsilane	C11-A121
Dichlorfos	C11-A055
Dichlorid-dioxid Sírový	C11-A158
Dichloridodioxidosulfur	C11-A158
Dichloridooxidosulfur	C03-C040
Dichloridophosphoric Acid Ethyl	C01-C160
Dichloridophosphoric Acid Methyl Ester	C01-C161
Dichlorine	C10-A001
Dichlorman	C11-A055
Dichloro	C01-C052
Dichloro 2,2 Dichloroethane	C11-A165
Dichloro Sulfide	C03-C039
Dichloro Sulfone	C11-A158
Dichloro(2-chlorovinyl)arsine	C04-A002
Dichloro-(2-chlorovinyl)arsine	C04-A002
Dichloro(2-chlorovinyl)arsine E-Isomer	C04-A002
Dichloro(2-chlorovinyl)arsine, (E)-	C04-A002
Dichloro(beta-chlorovinyl)arsine	C04-A002
Dichloro(dimethylamino)phosphine Oxide	C01-C162
Dichloro(ethyl)arsane	C04-A001
Dichloro(ethyl)arsine	C04-A001
Dichloro(ethyl)phosphane	C01-C093
Dichloro(methyl)phosphane	C01-C065

Dichloro(phenyl)arsane	C04-A004
Dichloro(phenylimino)methane	C10-A013
Dichloro(β-chlorovinyl)arsine	C04-A002
Dichloro-[(E)-2-chloroethenyl]arsane	C04-A002
Dichloro-1,2-ethane	C11-A070
Dichlorodiethyl Ether	C11-A017
Dichlorodiethyl Sulfide	C03-A001
Dichlorodiethyl Sulfone	C03-D055
Dichlorodimethyl Ether	C10-A011
Dichlorodimethyl Ether, Symmetrical	C10-A011
Dichlorodisulfane	C03-C038
Dichlorodisulphane	C03-C038
Dichloroethenyl Dimethyl Phosphate	C11-A055
Dichloroether	C11-A017
Dichloroethoxyphosphine Oxide	C01-C160
Dichloroethyl Disulfide	C03-D
Dichloroethyl Ether	C11-A017
Dichloroethyl Oxide	C11-A017
Dichloroethyl Sulfide	C03-A001
Dichloroethyl Sulfoxide	C03-D056
Dichloroethyl Sulphoxide	C03-D056
Dichloroethylarsine	C04-A001
Dichloroethylene	C11-A070
Dichloro-ethylphosphane	C01-C093
Dichloroethylphosphine	C01-C093
Dichloroethylphosphine Oxide	C01-C094
Dichloroethylphosphine Sulfide	C01-C163
Dichloro-ethyl-sulfanylidene-λ5-phosphane	C01-C163
Dichlorofluoronitrosomethane	C01-C155
Dichloro-fluoro-nitrosomethane	C01-C155
Dichlorofluoronitrozometan	C01-C155
Dichloroformaldehyde	C10-A003
Dichloroformaldehyde Oxime	C05-A001
Dichloroformaldoxime	C05-A001
Dichloroformossina	C05-A001
Dichloroformoxime	C05-A001
Dichloroformoxine	C05-A001
Dichloroisopropylphosphine Oxide	C01-C096
Dichloro-isopropyl-thioxo-phosphorane	C01-C070
Dichloroketone	C10-A003
Dichloromercury	C11-A096
Dichloromethanone Oxime	C05-A001
Dichloromethyl Ether	C10-A011
Dichloromethyl Ether, Symmetrical	C10-A011
Dichloromethyl Phosphine Oxide	C01-C052
Dichloromethylarsine	C04-A003
Dichloromethyldiethylamine Hydrochloride	C03-A017
Dichloromethylphenyl Silane	C11-A121
Dichloromethylphosphine	C01-C065

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Dichloromethylphosphine Oxide	C01-C052
Dichloromethylphosphine Sulfide	C01-C066
Dichloro-methyl-sulfanylidene-λ5-phosphane	C01-C066
Dichlorophenylarsine	C04-A004
Dichlorophenylmethylsilane	C11-A121
Dichlorophormoxine	C05-A001
Dichlorophos	C11-A055
Dichlorophosphoric Acid, Ethyl Ester	C01-C160
Dichlorophosphoric Dimethylamide	C01-C162
Dichlorophosphoryloxymethane	C01-C161
Dichloro-propan-2-yl-sulfanylidenephosphorane	C01-C070
Dichloro-propan-2-yl-sulfanylidene-λ5-phosphane	C01-C070
Dichloropropylphosphine Oxide	C01-C095
Dichlorosilane	C11-A054
Dichlorosulfane	C03-C039
Dichlorosulfide	C03-C039
Dichlorosulfone	C11-A158
Dichlorosulfoxide	C03-C040
Dichlorosulphane	C03-C039
Dichlorovas	C11-A055
Dichlorovinphos	C11-A055
Dichlorovinyl Dimethyl Phosphate	C11-A055
Dichlorovos	C11-A055
Dichlorphos	C11-A055
Dichlorsilane	C11-A054
Dichlorure D'ethylene	C11-A070
Dichlorure de Mercure	C11-A096
Dichlorvos	C11-A055
Dichlorvosum	C11-A055
Dicid	C11-A051
Dick	C04-A001
Dicloreto de Dimetilaminofosforilo	C01-C162
Dicloreto de Mercúrio	C11-A096
Diclorhidrină Sulfurică	C11-A158
Dicloruro de 1,1'-Dimetil-4,4'-bipiridilo (V)	C11-A132
Dicloruro de Sulfurilo	C11-A158
Dicloruro di Solforile	C11-A158
Diclorvos	C11-A055
Dicrotofos	C11-A056
Dicrotophos	C11-A056
Dicyan	C07-A005
Dicyanogen	C07-A005
Dicyanokvicksilver	C11-A100
Dicyanomercury	C11-A100
Dicyanozinc	C07-C010
Dicyclohexyl Urea	C01-D171
Dicyclohexylcarbodiamide	C01-D171
Dicyclohexylcarbodiimide	C01-C056
Dicyclohexylurea	C01-D171
Dicylcohexylurea	C01-D171

Didakene	C11-A136
DIEA	C01-D176
Diethamine	C01-C097
Diethanol Sulfide	C03-C037
Diethanolamine	C03-D060
Diethanolethylamine	C03-C044
Diethanolmethylamine	C03-C043
Diethenyl Sulfide	C03-D051
Diethion	C11-A065
Diethoxy Thiophosphoric Acid Ester of 2-Ethylmercaptoethanol	C11-A050
Diethoxy-(2-ethylsulfanylethoxy)-sulfanylidene-λ5-phosphane;1-diethoxyphosphorylsulfanyl-2-ethylsulfanylethane	C11-A050
Diethoxy-(2-ethylsulfanylethylsulfanyl)-sulfanylidenephosphorane	C11-A062
Diethoxy-(2-ethylsulfanylethylsulfanyl)-sulfanylidene-λ5-phosphane	C11-A062
Diethoxy-(4-nitrophenoxy)-sulfanylidene-λ5-phosphane	C11-A133
Diethoxy-(6-methyl-2-propan-2-ylpyrimidin-4-yl)oxy-sulfanylidene-λ5-phosphane	C11-A051
Diethoxy-(6-methyl-2-propan-2-ylpyrimidin-4-yl)oxy-sulfanylidenephosphorane	C11-A051
Diethoxy-(ethylsulfanylmethylsulfanyl)-sulfanylidene-λ5-phosphane	C11-A138
Diethoxy, Nitro-phenoxy Phosphorothioate	C11-A133
Diethoxy-[(2-isopropyl-6-methyl-4-pyrimidinyl)oxy]-thioxophosphorane	C11-A051
Diethoxyethylphosphine Oxide	C01-C090
Diethoxyfosfinothioyloxy-diethoxy-sulfanylideen-λ5-fosfaan	C11-A161
Diethoxymethylphosphine	C01-C
Diethoxymethylphosphine Oxide	C01-C089
Diethoxyphosphine Oxide	C01-C087
Diethoxyphosphinic Acid	C01-D173
Diethoxyphosphinothioyloxy-diethoxy-sulfanylidene-λ5-phosphane	C11-A161
Diethoxyphosphinothioylsulfanylmethylsulfanyl-diethoxy-sulfanylidene-lambda5-phosphane	C11-A065
Diethoxyphosphinothioylsulfanylmethylsulfanyl-diethoxy-sulfanylidenephosphorane	C11-A065
Diethoxyphosphinothioylsulfanylmethylsulfanyl-diethoxy-sulfanylidene-λ5-phosphane	C11-A065
Diethoxyphosphinous Acid	C01-C087
Diethoxyphosphoryl Diethyl Phosphate	C11-A167
Diethoxy-sulfanyl-sulfanylidene-λ5-phosphane	C01-C073
Diethoxythiophosphoric Acid Ester of 2-Ethylmercaptoethanol	C11-A050
Diethychlorophosphite	C01-C159
Diethyene Disulfide	C03-D059
Diethyl {[(tert-Butylsulfanyl)methyl]sulfanyl}(sulfanylidene)phosphonite	C11-A163
Diethyl 1-(2,4-Dichlorophenyl)-2-chlorovinyl Phosphate	C11-A037
Diethyl 1-Methylethylphosphonate	C01-C091
Diethyl 2-Chloro-1-(2,4-dichlorophenyl)vinyl Phosphate	C11-A037
Diethyl 2-Isopropyl-4-methyl-6-pyrimidinyl Phosphorothionate	C11-A051
Diethyl 2-Isopropyl-4-methyl-6-pyrimidyl Thionophosphate	C11-A051
Diethyl 2-Isopropyl-6-methyl-4-pyrimidinyl Phosphorothionate	C11-A051
Diethyl 4-(2-Isopropyl-6-methylpyrimidinyl)phosphorothionate	C11-A051
Diethyl 4-Nitrophenyl Phosphorothioate	C11-A133
Diethyl 4-Nitrophenyl Phosphorothionate	C11-A133
Diethyl Acid Phosphate	C01-D173
Diethyl Acid Phosphite	C01-C087
Diethyl Amine	C01-C097

(*Continued*)

Diethyl Chloridophosphite	C01-C159
Diethyl Chlorophosphite	C01-C159
Diethyl Chlorophosphonite	C01-C159
Diethyl Dimethylphosphoramidate	C01-C
Diethyl Dimpylatum	C11-A051
Diethyl Dithiophosphate	C01-C073
Diethyl Ester of Phosphorodithioic Acid	C01-C073
Diethyl Ethanephosphonate	C01-C090
Diethyl Ethylphosphonate	C01-C090
Diethyl Hydrogen Phosphate	C01-D173
Diethyl Hydrogen Phosphite	C01-C087
Diethyl Hydrogen Phosphonate	C01-C087
Diethyl Isopropylphosphonate	C01-C091
Diethyl Methanephosphonate	C01-C089
Diethyl Methanephosphonite	C01-C
Diethyl Methylphosphonate	C01-C089
Diethyl Methylphosphonite	C01-C
Diethyl N,N-Dimethylosphoramidate	C01-C
Diethyl N,N-Dimethylphosphoramidate	C01-C
Diethyl N,N-Dimethylphosphoramide	C01-C
Diethyl O-(2-Isopropyl-6-methyl-4-pyrimidinyl) Phosphorothioate	C11-A051
Diethyl O-p-Nitrophenyl Phosphorothioate	C11-A133
Diethyl O-p-Nitrophenyl Phosphorothioic Acid	C11-A133
Diethyl para-Nitrophenol Thiophosphate	C11-A133
Diethyl para-Nitrophenyl Phosphorothionate	C11-A133
Diethyl para-Nitrophenyl Thionophosphate	C11-A133
Diethyl Parathion	C11-A133
Diethyl Phosphate	C01-D173
Diethyl Phosphite	C01-C087
Diethyl Phosphonate	C01-C087
Diethyl Phosphoric Acid	C01-D173
Diethyl Phosphorochloridite	C01-C159
Diethyl Phosphorodithioate	C01-C073
Diethyl Phosphorothionate	C01-C074
Diethyl Phosphothionate	C01-C074
Diethyl p-Nitrophenyl Monothiophosphate	C11-A133
Diethyl p-Nitrophenyl Phosphorothionate	C11-A133
Diethyl p-Nitrophenyl Thionophosphate	C11-A133
Diethyl p-Nitrophenyl Thiophosphate	C11-A133
Diethyl S-(2-Ethyl-N,N-diethylamino) Phosphorothioate Hydrogen Oxalate	C01-A014
Diethyl S-(2-N,N-Diethylamino-ethyl) Phosphorothioate Hydrogen Oxalate	C01-A014
Diethyl S-(beta-Diethylamino)ethyl Thiophosphate, Hydrogen Oxalate	C01-A014
Diethyl S-(beta-Diethylaminoethyl) Thiophosphate, Hydrogen Oxalate	C01-A014
Diethyl S-(β-Diethylamino)ethyl Thiophosphate, Hydrogen Oxalate	C01-A014
Diethyl S-(β-Diethylaminoethyl) Thiophosphate, Hydrogen Oxalate	C01-A014
Diethyl S-2-Diethylaminoethyl Phosphorothioate	C01-A014
Diethyl Wasserstoff Phosphite	C01-C087
Diethyl(2-hydroxyethyl)amine	C01-C103
Diethyl(m-hydroxyphenyl)methylammonium Iodide Dimethylcarbamate	C02-A050
Diethyl(β-hydroxyethyl)amine	C01-C103

Diethylamin	C01-C097
Diethylamine	C01-C097
Diethyl-amine	C01-C097
Di-ethylamine	C01-C097
Diethylamine, 2,2'-Dichloro-n-butyl-	C03-A036
Diethylamine, 2,2'-Dichloro-N-methyl-	C03-A017
Diethylamine, 2,2'-Dichloro-N-methyl-, Hydrochloride	C03-A017
Diethylamine, 2,2'-Difluoro-N-methyl-	C03-A019
Diethylamine, 2,2'-Dihydroxy-	C03-D060
Diethylamine, N-Butyl-2,2'-dichloro-	C03-A036
Diethylamino)ethyl) O,O-Diethyl Phosphorothioate Hydrogen Oxalate	C01-A014
Diethylaminoethanol	C01-C103
Diethylaminomethanimine {Novichok Precursor}	C01-C
Diethyl-chlorophosphite	C01-C159
Diethylchlorophosphonite	C01-C159
Diethylene Disulfide	C03-D059
Diethylene Glycol Dichloride	C11-A017
Diethylethanolamine	C01-C103
Diethylethylphosphonate	C01-C090
Diethylfosfit	C01-C087
Diethylhydrogen Phosphorothionate	C01-C074
Diethylmonoethanolamine	C01-C103
Diethylolamine	C03-D060
Diethyl-para-nitrophenyl Monothiophosphate	C11-A133
Diethylphosphate	C01-D173
Diethylphosphite	C01-C087
Diethylphosphoramidic Difluoride	C01-C071
Diethylphosphoramidofluoridic Acid 2-(Diethylamino)ethyl Ester	C01-A032
Diethylphosphoramidofluoridic Acid 2-(Dimethylamino)ethyl Ester	C01-A030
Diethylphosphoramidoyl Difluoride	C01-C071
Diethylphosphoric Acid	C01-D173
Diethyl-p-nitrophenyl Monothiophosphate	C11-A133
Dietil Tiofosfato de p-Nitrofenila	C11-A133
Dietilamina	C01-C097
Dietoxifosforil Dietil Fosfato	C11-A167
Dietylamine	C01-C097
Dietylparation	C11-A133
Difenilmetan-4,4'-diisocianato	C11-A113
Difenil-metan-diisocianato	C11-A113
Difenilmetano Diisocianato	C11-A113
Difenilmetano-4,4'-diisocianato	C11-A113
Difenylmethaan-diisocyanaat	C11-A113
Difenylmethaan-dissocyanaat	C11-A113
Difluorek [(Chloroetoksyfosfinylo)oksy]karbonoimidowy	C01-C126
Difluorek [(Chloroizopropoksyfosfinylo)oksy]karbonoimidowy	C01-C137
Difluorek [(Chlorometoksyfosfinylo)oksy]karbonoimidowy	C01-C118
Difluorek [(Chloropropoksyfosfinylo)oksy]karbonoimidowy	C01-C136
Difluorek [(Dichlorofosfinylo)oksy]karbonoimidowy	C01-C110
Difluorek [(Etoksyfluorofosfinylo)oksy]karbonoimidowy	C01-A047

(*Continued*)

Difluorek [(Fluorometoksyfosfinylo)oksy]karbonoimidowy	C01-A043
Difluoridodioxidosulfur	C11-A160
Difluoridophosphoric Acid Ethyl Ester	C01-C160
Difluorine	C11-A076
Difluoro	C01-C053
Difluoro Sulfone	C11-A160
Difluoro(diethylamino)phosphine Oxide	C01-C071
Difluorodioxosulfur	C11-A160
Difluoroformaldehyde	C11-A034
Difluoroisopropylphosphine Oxide	C01-C068
Difluoromethylphosphine	C01-C
Difluoromethylphosphine Oxide	C01-C053
Difluorooxomethane	C11-A034
Difluorophosgene	C11-A034
Difluorophosphoric Acid Ethyl Ester	C01-C160
Difluorophosphorsaeure-aethylester	C01-C160
Difluorophosphoryloxymethane {Novichok Precursor}	C01-C
DIFO	C11-A058
Difonate	C11-A082
Difonatol	C11-A082
Difonatul	C11-A082
Difosgen	C10-A004
Difosgene	C10-A004
Difosgeno	C10-A004
Difozgen	C10-A004
Dihlorvos	C11-A055
Dihydridoselenium	C11-A091
Dihydridosulfur	C07-A006
Dihydro-1H-azirine	C11-A072
Dihydroazirene	C11-A072
Dihydroazirine	C11-A072
Dihydrogen Methylphosphonate	C01-C060
Dihydrogen Monoselenide	C11-A091
Dihydrogen Monosulfide	C07-A006
Dihydrogen Selenide	C11-A091
Dihydrogen Sulfate	C11-A157
Dihydrogen Sulfide	C07-A006
Dihydrogenselenid	C11-A091
Dihydrooxirene	C11-A071
Dihydroxyethyl Sulfide	C03-C037
Dihydroxyethyl Tallowamine Oxide	C03-D060
Diiodoformaldehyde Oxime	C05-A003
Diiodoformaldoxime	C05-A003
Diiodoformoxime	C05-A003
Diisocianato de 4,4´-Metilendifenilo	C11-A113
Diisocianato de 4-Metil-m-benceno	C11-A173
Diisocianato de Difenilmetano	C11-A113
Diisocianato de Tolueno	C11-A173
Diisocianato di 4,4'-Metilendifenile	C11-A113
Diisocianato di Toluene	C11-A173

Diisocyanate de Toluène	C11-A173
Di-isocyanate de Toluylene	C11-A173
Di-iso-cyanatoluene	C11-A173
Diisocyanat-toluol	C11-A173
Diisopropyl Methanephosphonate	C01-C057
Diisopropyl Methylphosphonate	C01-C057
Diisopropylamine	C01-D174
Diisopropylaminoethanethiol	C01-C105
Diisopropylaminoethyl Mercaptan	C01-C105
Diisopropylaminoethyl Methyl Thiolophosphonate	C01-D177
Diisopropylaminoethyl Sulfide	C01-C105
Diisopropylaminoethylthiol	C01-C105
Diisopropylaminomethanimine {Novichok Precursor}	C01-C
Diisopropylaminothanethiol	C01-C105
Diisopropylcarbodiimide	C01-C058
Diisopropylethanolamine	C01-C104
Diisopropylethylamine	C01-D176
Diisopropylethylmercaptan	C01-C105
Diisopropylmethanediimine	C01-C058
Diizocyjanian Tolueno-2,4-diylu	C11-A173
Diizocyjanian Tolueno-2,6-diylu	C11-A174
Dijodformaldoxim	C05-A003
Dijodformoxim	C05-A003
Dijodoximinomethane	C05-A003
Diketeen	C11-A057
Diketene	C11-A057
Dikitene	C11-A057
Diklor	C11-A038
Dimaz	C11-A062
Di-Me Polysulfides	C01-C062
Dimefox	C11-A058
Dimercury Dinitrate	C11-A099
Dimethlamine	C01-C098
Dimethlyamine	C01-C098
Dimethoate Oxon	C11-A131
Dimethoate-met	C11-A131
Dimethoxon	C11-A131
Dimethoxy-(4-nitrophenoxy)-sulfanylidene-λ5-phosphane	C11-A120
Dimethoxy(oxo)phosphanium	C01-C085
Dimethoxymethyl Phosphine Oxide	C01-C059
Dimethoxyphosphine Oxide	C01-C085
Dimethyamine	C01-C098
Dimethyl (1-Methoxycarboxypropen-2-yl)phosphate	C11-A123
Dimethyl (2-Methoxycarbonyl-1-methylvinyl) Phosphate	C11-A123
Dimethyl (2Z)-3-[(Dimethoxyphosphoryl)oxy]pent-2-enedioate	C11-A018
Dimethyl (E)-1-Methyl-2-(methylcarbamoyl)vinyl Phosphate	C11-A125
Dimethyl (E)-2-Dimethyl-carbamoyl-1-methylvinyl Phosphate	C11-A056
Dimethyl (Z)-3-dimethoxyphosphoryloxypent-2-enedioate	C11-A018
Dimethyl [(E)-4-(Methylamino)-4-oxobut-2-en-2-yl] Phosphate	C11-A125

(*Continued*)

Dimethyl [(Z)-4-(methylamino)-4-oxobut-2-en-2-yl] Phosphate	C11-A125
Dimethyl 1,3-Bis(carbomethoxy)-1-propen-2-yl Phosphate	C11-A018
Dimethyl 1,3-Bis(carboxethoxy)-1-propen-2-yl Phosphate	C11-A018
Dimethyl 1,3-Dicarbomethoxy-1-propen-2-yl Phosphate	C11-A018
Dimethyl 1-Dimethylcarbamoyl-1-propen-2-yl Phosphate	C11-A056
Dimethyl 1-Methyl-2-(methylcarbamoyl)vinyl Phosphate, Cis	C11-A125
Dimethyl 2,2-Dichloroethenyl Phosphate	C11-A055
Dimethyl 2,2-Dichlorovinyl Phosphate	C11-A055
Dimethyl 2,2-Dichlorovinylphosphate	C11-A055
Dimethyl 2-Dimethylcarbamoyl-1-methylvinyl Phosphate	C11-A056
Dimethyl 2-Methylcarbamoyl-1-methylvinyl Phosphate	C11-A125
Dimethyl 3-((Dimethoxyphosphinyl)oxy)-2-pentenedioate	C11-A018
Dimethyl 3-(Dimethoxyphosphinyloxy)glutaconate	C11-A018
Dimethyl 3-Hydroxyglutaconate Dimethyl Phosphate	C11-A018
Dimethyl 4-Nitrophenyl Phosphorothioate	C11-A120
Dimethyl 4-Nitrophenyl Phosphorothionate	C11-A120
Dimethyl Acid Phosphite	C01-C085
Dimethyl Carbamoyl Chloride	C02-C052
Dimethyl Carbamyl Chloride	C02-C052
Dimethyl Dichlorovinyl Phosphate	C11-A055
Dimethyl Disulfide	C01-C062
Dimethyl Ester of Methylphosphonic Acid	C01-C059
Dimethyl Ester of Sulfuric Acid	C03-A009
Dimethyl Ester with (E)-3-Hydroxy-N,N-dimethylcrotonamide Phosphoric Acid	C11-A056
Dimethyl Ethanephosphonate	C01-C
Dimethyl Ethylphosphonate	C01-C
Dimethyl Hydrazine	C11-A059
Dimethyl Hydrogen Phosphite	C01-C085
Dimethyl Hydrogen Phosphonate	C01-C085
Dimethyl Ketone Cyanohydrin	C11-A001
Dimethyl Methane Phosphonate	C01-C059
Dimethyl Methoxycarbonylpropenyl Phosphate	C11-A123
Dimethyl Methylphosphonate	C01-C059
Dimethyl Methylphosphonoate	C01-C059
Dimethyl Monosulfate	C03-A009
Dimethyl O,O-Dichlorovinyl-2,2-phosphate	C11-A055
Dimethyl para-Nitrophenyl Phosphorothionate	C11-A120
Dimethyl para-Nitrophenyl Thiophosphate	C11-A120
Dimethyl Parathion	C11-A120
Dimethyl Phosphate Ester of 3-Hydroxy-N-methyl-cis-crotonamide	C11-A125
Dimethyl Phosphate Ester with (E)-3-Hydroxy-N,N-dimethylcrotonamide	C11-A056
Dimethyl phosphate Ester with (E)-3-Hydroxy-N-methylcrotonamide	C11-A125
Dimethyl Phosphate Ester with 3-Hydroxy-N,N-dimethyl-cis-crotonamide	C11-A056
Dimethyl Phosphate of 3-Hydroxy-N,N-dimethyl-cis-crotonamide	C11-A056
Dimethyl Phosphite	C01-C085
Dimethyl Phosphonate	C01-C085
Dimethyl p-Nitrophenyl Phosphorothionate	C11-A120
Dimethyl p-Nitrophenyl Thiophosphate	C11-A120
Dimethyl S-((4-Oxo-1,2,3-benzotriazin-3(4 H)-yl)methyl) Phosphorodithioate	C11-A013
Dimethyl S-(3-(Mercaptomethyl)-1,2,3-benzotriazin-4(3 H)-one) Phosphorodithioate	C11-A013

Dimethyl Sulfate	C03-A009
Dimethyl Sulphate	C03-A009
Dimethyl Viologen	C11-A132
Dimethyl Viologen Chloride	C11-A132
Dimethyl(2-chloroethyl)amine	C01-C099
Dimethyl(E)-1-methyl-2-(methylcarbamoyl)vinylfosfaat	C11-A125
Dimethyl-(E)-1-methyl-2-(methylcarbamoyl)vinylphosphat	C11-A125
Dimethyl-1,1'-dichloroether	C10-A011
Dimethyl-1,3-benzodioxol-4-yl Methylcarbamate	C11-A014
Dimethyl-1,3-di(carbomethoxy)-1-propen-2-yl Phosphate	C11-A018
Dimethyl-13-bis(carbomethoxy)-1-propen-2-yl phosphate	C11-A018
Dimethyl-1-carbomethoxy-1-propen-2-yl Phosphate	C11-A123
Dimethyl-4-(methylthio)phenyl Methylcarbamate	C11-A106
Dimethyl-4,4'-bipyridinium Dichloride	C11-A132
Dimethylacetonitrile	C11-A095
Dimethylamid Kyseliny Chlormravenci	C02-C052
Dimethylamidoethoxyphosphoryl Cyanide	C01-A001
Dimethylamidophosphoric Acid Dichloride	C01-C162
Dimethylamidophosphoric Dichloride	C01-C162
Dimethylamine	C01-C098
Di-Methylamine	C01-C098
Dimethylamino Methane	C11-A178
Dimethylamino-1-(methylthio)glyoxal O-Methylcarbamoylmonoxime	C11-A147
Dimethylaminocarbonyl Chloride	C02-C052
Dimethylaminocyanophosphoric Acid Ethyl Ester	C01-A001
Dimethylaminocyanphosphorsaeureaethylester	C01-A001
Dimethylaminodichlorophosphine Oxide	C01-C162
Dimethylaminoethoxy-cyanophosphine Oxide	C01-A001
Dimethylaminoethoxyphosphoryl Cyanide	C01-A001
Dimethylaminoethyl Chloride	C01-C099
Dimethylaminoethyl Chloride Hydrochloride	C01-C099
Dimethylaminoethyloxycyanophosphine Oxide	C01-A001
Dimethylaminophosphoryl Dichloride	C01-C162
Dimethylammonia	C01-C098
Dimethylarnine	C01-C098
Dimethylcarbamic Acid Chloride	C02-C052
Dimethylcarbamic Chloride	C02-C052
Dimethylcarbamidoyl Chloride	C02-C052
Dimethylcarbamoyl Chloride	C02-C052
Dimethylcarbamyl Chloride	C02-C052
Dimethylchloroether	C11-A044
Dimethylchloroformamide	C02-C052
Dimethyldichlorovinyl Phosphate	C11-A055
Dimethyldithiophosphoric Acid N-Methylbenzazimide Ester	C11-A013
Dimethylene Oxide	C11-A071
Dimethylene Sulfide	C03-D047
Dimethyleneimine	C11-A072
Dimethylenimine	C11-A072
Dimethylester Kyselini Fosforite	C01-C085

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Dimethylester Kyseliny Sirove	C03-A009
Dimethylethylphosphonate	C01-C
Dimethylformamidine {Novichok Precursor}	C01-C
Dimethylfosfit	C01-C085
Dimethylfosfonat	C01-C085
Dimethylhydrazine, Symmetrical	C11-A059
Dimethylhydrogen Phosphite	C01-C085
Dimethylhydrogenphosphite	C01-C085
Dimethylkarbamoylchlorid	C02-C052
Dimethylmercure	C11-A060
Dimethylmercury	C11-A060
Dimethylmethaneamine	C11-A178
Dimethylphosphite	C01-C085
Dimethylphosphoramidic Dichloride	C01-C162
Dimethylphosphoramidocyanidic Acid, Ethyl Ester	C01-A001
Dimethylphosphoramidofluoridic Acid 2-(Diethylamino)ethyl Ester	C01-A031
Dimethylphosphoramidofluoridic Acid 2-(Dimethylamino)ethyl Ester	C01-A029
Dimethylphosphoroamidocyanidic Acid	C01-A001
Dimethylphosphorodichloridic Amide	C01-C162
Dimethylpolysulfide	C01-C062
Dimethyl-quecksilber	C11-A060
Dimethyl-S-(N-methyl-carbamoyl-methyl)phosphorothiolate	C11-A131
Dimethylsulfaat	C03-A009
Dimethylsulfat	C03-A009
Dimetilamidofosforni Dihlorid	C01-C162
Dimetilsolfato	C03-A009
Dimetox	C11-A058
Dimetyl Amine	C01-C098
Dimitan	C03-A017
DIMP	C01-C057
Dimpilato	C11-A051
Dimpylate	C11-A051
Dimpylatum	C11-A051
Dimustard Ether	C03-A003
Di-n-butyl Methanephosphonate	C01-C092
Di-n-butyl Methylphosphonate	C01-C092
Dinitrogen Tetroxide	C11-A128
Di-O-Ethyl Dithiophosphate	C01-C073
Diolamine	C03-D060
Diossido di Azoto	C11-A128
Diossido di Zolfo	C11-A154
Dioxamyl	C11-A147
Dioxan-2,3-diyl-bis(O,O-diethylphosphorothiolothionate)	C11-A061
Dioxane Phosphate	C11-A061
Dioxane-2,3-diyl O,O,O',O'-Tetraethyl Phosphorodithioate	C11-A061
Dioxanedithiol S,S-Bis(O,O-diethyl Phosphorodithioate)	C11-A061
Dioxathion	C11-A061
Dioxation	C11-A061
Dioxationum	C11-A061
Dioxiclear	C11-A038

Dioxid de Azot	C11-A128
Diòxid de Nitroge	C11-A128
Dioxid de Sulf	C11-A154
Dioxidiclorură de Sulf	C11-A158
Dióxido de Azufre	C11-A154
Dióxido de Enxofre	C11-A154
Dióxido de Nitrogénio	C11-A128
Dioxidosulfur	C11-A154
Dioxido-λ5-chloranyl	C11-A038
Dioxonium Perchlorate	C11-A135
Dioxothion	C11-A061
Dioxo-λ4-sulfane	C11-A154
Dioxyde D'azote	C11-A128
Dioxyde de Soufre	C11-A154
DIPA	C01-D174
DIPC	C01-C058
DIPCDI	C01-C058
Di-p-fenilenisocianato de Metilo	C11-A113
Diphenyl Methane Diisocyanate	C11-A113
Diphenylmethan-4,4'-diisocyanat	C11-A113
Diphenylmethane 4,4'-Diisocyanate	C11-A113
Diphenylmethane Diisocyanate	C11-A113
Diphenylmethane p,p'-Diisocyanate	C11-A113
Diphenylmethane para,para'-Diisocyanate	C11-A113
Diphenylmethane-4,4'-diisocyanate	C11-A113
Diphenylmethyl Diisocyanate	C11-A113
Diphenylmethylene Diisocyanate	C11-A113
Diphonate	C11-A082
Diphos	C10-A004
Diphosgen	C10-A004
Diphosgene	C10-A004
Di-Phosgene	C10-A004
Diphosphoramide, Octamethyl-	C11-A148
Diphosphoric Acid Tetraethyl Ester	C11-A167
Diphosphoric Acid Tetrakis-dimethylamide	C11-A148
Diphosphorous Acid, Tetraethyl Ester	C11-A167
Diphosphorus Pentasulfide	C01-C084
Dipofene	C11-A051
Dipping Acid	C11-A157
Dipropan-2-ylmethanediimine	C01-C058
Dipropylamine, 2,2'-Dichloro-N-2-(chloroethyl)-	C03-A032
Dipropylamine, 2,2'-Dichloro-N-methyl-	C03-A031
Dipropylaminomethanimine {Novichok Precursor}	C01-C
Direktlost	C03-A001
Discipline	C11-A016
Disipton	C11-A062
Disodioarsanylsodium	C08-C004
Disodium Difluoride	C01-C077
Disodium Hexafluorosilicate	C01-C106

(*Continued*)

Disodium Monosulfide	C03-C042
Disodium Silicofluoride	C01-C106
Disodium Sulfide	C03-C042
Disodium; Sulfanide	C03-C042
Disonex	C11-A051
Dispersul	C01-C061
Distilled Mustard	C03-A001
Distillex DS6	C11-A081
Disulfane, Bis(2-diisopropylaminoethyl)-	C01-D167
Disulfaton	C11-A062
Disulfide, Bis(2-chloroethyl)	C03-D
Disulfidocarbon	C11-A033
Disulfoton	C11-A062
Disulfur Decafluoride	C10-A016
Disulfur Dichloride	C03-C038
Disulfur Tetrachloride	C03-C039
Disulphur Decafluoride	C10-A016
Disulphur Dichloride	C03-C038
Disulphur Tetrachloride	C03-C039
Disulphuric Acid	C11-A157
Disyston	C11-A062
Disystox	C11-A062
Dithallium Sulfate	C11-A171
Dithallium Sulphate	C11-A171
Dithalliumsulfat	C11-A171
Dithiane	C03-D059
Dithiaoctanediol	C03-D046
Dithio	C11-A161
Dithiocarbonic Anhydride	C11-A033
Dithiodemeton	C11-A062
Dithiodiphosphoric Acid, Tetraethyl Ester	C11-A161
Dithioethylene Glycol	C03-D048
Dithiofos	C11-A161
Dithioglycol	C03-D048
Dithione	C11-A161
Dithionic Acid	C11-A157
Dithiophos	C11-A161
Dithiophosphate de O,O-Diethyle et D'ethylthiomethyle	C11-A138
Dithiophosphate de O,O-Diethyle et de (4-Chloro-phenyl) Thiomethyle	C11-A036
Dithiophosphate de O,O-Diethyle et de S-(2-Ethylthio-ethyle)	C11-A062
Dithiophosphoric Acid O,O'-Dimethyl-S-[(2-methoxy-1,3,4-thiadiazol-5(4 H)-on-4-yl)methyl] Ester	C11-A105
Dithiophosphoric Acid O,O'-Dimethyl-S-[(5-methoxy-1,3,4-thiadiazol-2(3 H)-on-3-yl)methyl] Ester	C11-A105
Dithiophosphoric Acid O,O'-Dimethyl-S-[(5-methoxy-1,3,4-thiadiazol-2(3 H)-one-3-yl] Ester	C11-A105
Dithiophosphoric Acid, O,O-Diethyl Ester	C01-C073
Dithiophosphorsäure-O,O-dimethyl-S-(2-(methylamino)-2-oxo-ethyl)ester	C11-A131
Dithiopyrophosphate de Tetraethyle	C11-A161
Dithiopyrophosphoric Acid, Tetraethyl Ester	C11-A161
Dithiosystox	C11-A062
Dithiotep	C11-A161
Dithioxomethane	C11-A033

Ditiopirofosfato de O,O,O,O-Tetraetilo	C11-A161
Ditlenek Siarki	C11-A154
Ditrichloromethyl Carbonate	C10-A005
Divinyl Sulfide	C03-D051
Divinyl Sulfone	C03-D049
Divinyl Sulfoxide	C03-D050
Divinyl Sulphone	C03-D049
Divinyl Thioether	C03-D051
Divipan	C11-A055
Dizictol	C11-A051
Diziktol	C11-A051
Dizinil	C11-A051
Dizinon	C11-A051
DJ	C04-A004
DK	C11-A057
DL	C03-A001
Dlethylchlorophosphite	C01-C159
D-Lost	C03-A001
DMAEDEAFP	C01-A030
DMAEDMAFP	C01-A029
DMAPDEAFP	C01-A034
DMAPDMAFP	C01-A033
DMCC	C02-C052
DMDS	C01-C062
Dmethylaminecyanoethoxyphosphine Oxide	C01-A001
DMH	C11-A059
DMHP	C01-C085
DMMP	C01-C059
DMP	C01-C085
DMPADC	C01-C162
DMPH	C01-C085
DMS	C03-A009
DMTP	C11-A105
DNTP	C11-A133
Dodecamolybdophosphoric Acid	C11-A124
Dojyopicrin	C10-A006
Dolco Mouse Cereal	C11-A159
Dolochlor	C10-A006
Dominator	C11-A125
Doppellost	C03-A001
Dormol	C11-A083
Double Green Cross (German WWI Shell) {Diphosgene (66%) and Trinitrotoluene (33%)}	C10-A004
Double Red Star (British WWI Cylinder Gas) {Hydrogen Sulfide (90%) and Carbon Disulfide (10%) Mixture}	C07-A006
Double Yellow Cross (German WWI Shell) {Sulfur Mustard (66%) and Trinitrotoluene (33%)}	C03-A001
Doubledown	C11-A082
Dow Fume	C11-A110
Dowcide 7	C11-A134
Dowfume 40	C11-A069

(*Continued*)

Dowfume EDB	C11-A069
Dowfume W-100	C11-A069
Dowfume W8	C11-A069
Dowfume W85	C11-A069
Dowfume W90	C11-A069
Dowicide 7	C11-A134
Dowicide EC-7	C11-A134
Dowicide G	C11-A134
Dowper	C11-A136
Doxcide 50	C11-A038
DP	C10-A004
DP-2	C11-A134
DPP	C11-A133
DPX 1410	C11-A147
Drawizon	C11-A051
Draza	C11-A106
Drexel Plant Bed Gas	C11-A110
DS5000000	C11-A015
DSDP	C01-A014
D-Stoff	C03-A009
D-Stoff	C10-A003
Du Pont 1179	C11-A107
Du Pont 1410	C11-A147
Dunet	C11-A107
Duo-Kill	C11-A055
Dura Klor	C11-A038
Durafos	C11-A123
Duraphat	C01-C077
Duraphos	C11-A123
Dura-treet	C11-A134
Duravos	C11-A055
Durham Nematicode EM 17.1	C11-A053
Durine	C11-A083
Durotox	C11-A134
Dušik (IV) Oksid	C11-A128
Dušik-dioksid	C11-A128
Dusty Mustard	C03-A001
Dutch Liquid	C11-A070
Dutch Oil	C11-A070
Dution	C11-A062
DW1960000	C11-A132
DW2275000	C11-A132
Dwubromoetan	C11-A069
Dwuchlorek 1,1'-Dwumetylo-4,4'-dwupirydyniowy	C11-A132
Dwuchlorodwuetylowy Eter	C11-A017
Dwuetyloamina	C01-C097
Dwumetylowy Siarczan	C03-A009
Dwutlenek Azotu	C11-A128
Dwutlenek Siarki	C11-A154
Dyanacide	C11-A137

Dycarb	C11-A014
Dyfonat	C11-A082
Dyfonate	C11-A082
Dýmavá Kyselina Sírová	C11-A157
Dymel 11	C11-A081
Dyphonate	C11-A082
Dyzol	C11-A051
- E -	
(E)-1-Arsoroso-2-chloroethene	C04-D008
(E)-2-Butenal	C11-A047
(E)-2-Dimethylcarbamoyl-1-methylvinyl Dimethyl Phosphate	C11-A056
(E)-3-(Dimethylamino)-1-methyl-3-oxo-1-propenyl Dimethyl Phosphate	C11-A056
(E)-3-(Dimethylamino)-1-methyl-3-oxoprop-1-enyl Dimethyl Phosphate	C11-A056
(E)-4-(Dimethylamino)-4-oxobut-2-en-2-yl Dimethyl Phosphate	C11-A056
(E)-Bromomethyleneamino Hypobromite	C05-A002
(E)-But-2-enal	C11-A047
(E)-Crotonaldehyde	C11-A047
(E)-Dimethyl 1-Methyl-3-(methylamino)-3-oxo-1-propenyl Phosphate	C11-A125
(E)-Lewisite 1	C04-A002
(E)-Monocrotophos	C11-A125
(E)-N,N-Bis(2-chloroethyl)prop-1-en-1-amine	C03-A027
(E,E,E)-Lewisite 3	C04-C007
(E,Z)-N,N-Diméthyl-2-méthylcarbamoyloxyimino-2-(méthylthio)acetamide	C11-A147
(Ethenesulfinyl)ethene	C03-D050
(Ethenesulfonyl)ethene	C03-D049
(Ethenylsulfanyl)ethene	C03-D051
(Ethenylsulfonyl)ethene	C03-D049
(Ethylthio)formic Acid Chloride	C11-A067
[(E)-(2-Methyl-2-methylsulfanylpropylidene)amino] N-Methylcarbamate	C11-A003
[(E)-4-Dimethylamino-4-oxobut-2-en-2-yl]dimethylfosfaat	C11-A056
[(Ethoxyfluorophosphinyl)oxy]carbonimidic Chloride Fluoride	C01-A046
[(Ethoxyfluorophosphinyl)oxy]carbonimidic Dichloride	C01-A045
[(Ethoxyfluorophosphinyl)oxy]carbonimidic Difluoride	C01-A047
{Ethoxy[3-methyl-4-(methylsulfanyl)phenoxy]phosphoryl}(propan-2-yl)amine	C11-A074
E	C03-A001
E 605	C11-A133
E.O.	C11-A071
E1	C10-A003
E-2-Butenal	C11-A047
E393	C11-A161
EA	C11-A068
EA 1033	C03-A001
EA 1034	C04-A002
EA 1053	C03-A018
EA 1205	C01-A001
EA 1208	C01-A002
EA 1210	C01-A003
EA 1212	C01-A005
EA 1251	C01-C053

(*Continued*)

EA 1253	C01-C052
EA 1285	C11-A167
EA 1356	C01-A008
EA 1664	C01-A015
EA 1699	C01-A018
EA 1701	C01-A017
EA 2192	C01-D177
EA 2223	C01-A007
EA 3148	C01-A019
EA 3317	C01-A020
EA 3534	C01-A008
EA 3887	C02-A001
EA 3887 A	C02-A001
EA 3948	C02-A002
EA 3966	C02-A003
EA 3990	C02-A004
EA 4026	C02-A005
EA 4038	C02-A006
EA 4048	C02-A007
EA 4056	C02-A008
EA 4057	C02-A009
EA 4181	C02-A010
EA 4196	C01-D167
EA 4352	C01-A009
EA 5365	C01-A029
EA 5414	C01-A033
EA 5488	C01-A035
EA 5533	C01-D169
EBA	C03-A016
Ebufos	C11-A031
Ecatox	C11-A133
ECF	C11-A066
E-Chlorovinylarsine Dichloride	C04-A002
ED	C04-A001
Edabrom	C11-A069
EDB	C11-A069
E-D-Bee	C11-A069
EDC	C11-A070
EDCO	C11-A110
Edemo	C01-A015
Edemo 3	C01-A015
E-DF	C01-C
EDMM	C01-A018
EDMP	C01-C064
EDRF	C11-A127
EF9100000	C10-A002
EF9200000	C11-A021
EF9350000	C11-A023
EF9360000	C11-A024
Ehtylene Dichloride	C11-A070

EI	C11-A072
Ekatine	C11-A062
Ekatox	C11-A133
Ektafos	C11-A056
Ektoband	C11-A051
EL	C04-A001
EL 970	C11-A008
EL2276000	C01-C102
EL7700000	C01-C101
Electro-CF 11	C11-A081
Electronic E-2	C11-A091
Elosal	C01-C061
Embafume	C11-A110
Embathion	C11-A065
Embechine	C03-A017
Embichen	C03-A017
Embichin 11	C03-A025
Embikhine	C03-A017
Embiquine	C03-A017
EMC	C11-A073
Emcon D	C11-A073
Emerald	C11-A046
Emerald Green	C11-A046
E-Monocrotophos	C11-A125
EMPA	C01-D168
Empower	C11-A016
EMPSH	C01-C069
EMPTA	C01-C069
Endocel	C11-A063
Endosol	C11-A063
Endotaf	C11-A063
Endothelium-derived Relaxing Factor	C11-A127
Endox	C11-A063
Endyl	C11-A036
Engravers Acid	C11-A126
Enolofos	C11-A037
Enso	C10-A001
Ensure	C11-A063
Ens-Zem Weevil Bait	C01-C106
ENT 54	C11-A002
ENT 1,501	C01-C106
ENT 1,860	C11-A136
ENT 15,108	C11-A133
ENT 17,798	C11-A064
ENT 20,738	C11-A055
ENT 20,993	C01-A014
ENT 22,374	C11-A123
ENT 22,897	C11-A061
ENT 23,233	C11-A013

(*Continued*)

ENT 23,347	C11-A062
ENT 23,437	C11-A062
ENT 23,708	C11-A036
ENT 24,042	C11-A138
ENT 24,105	C11-A065
ENT 24,969	C11-A037
ENT 24,980-X	C01-A014
ENT 25,726	C11-A106
ENT 27,093	C11-A003
ENT 27,129	C11-A125
ENT 27,193	C11-A105
ENT 27,341	C11-A107
ENT 27,396	C11-A103
ENT 50,324	C11-A072
EP-1	C01-C073
EP 30	C11-A134
Epifume {Aluminum Phosphide}	C11-A139
Epithioethane	C03-D047
EPN	C11-A064
Epoxy Ethane	C11-A071
EPTBO	C06-A002
Equigand	C11-A055
Equigard	C11-A055
Equigel	C11-A055
Equiguard	C11-A055
Erasol	C03-A017
Erasol Hydrochloride	C03-A017
Erasol-Ido	C03-A017
Esafluoruro di Selenio	C11-A149
Esafluoruro di Tungsteno	C11-A179
Esaidropiridina	C11-A141
Esbecythrin	C11-A049
Esgram	C11-A132
Eskimon 11	C11-A081
Essence	C11-A033
Essential Oils, Mustard	C11-A007
Estibano	C11-A153
Estibina	C11-A153
E-Stoff	C07-A002
Estricnidin-10-ona	C11-A159
Estricnina	C11-A159
Estrinidina-10-ona	C11-A159
Estrosel	C11-A055
Estrosol	C11-A055
Etanamina	C11-A068
Etbicuphat	C06-A002
Etbicyphat	C06-A002
Etbicythionat	C06-A005
Eth-2-ylamine	C11-A068
Ethamine	C11-A068

Ethanamine	C11-A068
Ethanamine, 2-Bromo-N,N-bis(2-bromoethyl)-	C03-A021
Ethanamine, 2-Chloro-N-(2-chloroethel)-N-methyl-	C03-A017
Ethanamine, 2-Chloro-N-(2-chloroethyl)-N-ethyl-	C03-A016
Ethanamine, 2-Chloro-N-(2-chloroethyl)-N-ethyl-, Hydrochloride	C03-A016
Ethanamine, 2-Chloro-N-(2-chloroethyl)-N-methyl-	C03-A017
Ethanamine, 2-Chloro-N-(2-chloroethyl)-N-methyl-, Hydrochloride	C03-A017
Ethanamine, 2-Chloro-N,N-bis(2-chloroethyl)-	C03-A018
Ethanamine, 2-Chloro-N,N-bis(2-chloroethyl)-, Hydrochloride	C03-A018
Ethanamine, 2-Chloro-N,N-bis(2-fluoroethyl)-	C03-A023
Ethanamine, 2-Chloro-N,N-dimethyl-	C01-C099
Ethanamine, 2-Chloro-N,N-dimethyl-, Hydrochloride	C01-C099
Ethanamine, 2-Fluoro-N-(2-fluoroethyl)-N-methyl-	C03-A019
Ethanamine, 2-Fluoro-N,N-bis(2-fluoroethyl)-	C03-A024
Ethanamine, N,N-Bis(2-chloroethyl)-2-fluoro-	C03-A022
Ethanamine, N-Ethyl	C01-C097
Ethanamine, N-Ethyl-	C01-C097
Ethanaminium, 2-[(Ethoxyethylphosphinyl)thio]-N,N,N-trimethyl-, Iodide	C01-A023
Ethanaminium, 2-[(Ethoxymethylphosphinyl)thio]-N,N,N-trimethyl-, Iodide	C01-A018
Ethanaminium, 2-[(Ethoxymethylphosphinyl)thio]-N,N-diethyl-N-methyl-, Iodide	C01-A015
Ethanaminium, 2-[[(Cyclohexyloxy)methylphosphinyl]thio]-N,N-diethyl-N-methyl-, Iodide	C01-A021
Ethanaminium, N,N,N-Triethyl-2-[(ethoxymethylphosphinyl)thio]-, Iodide	C01-A015
Ethanaminium, N,N,N-Trimethyl-2-[(ethoxyethylphosphinyl)thio]-, Iodide	C01-A023
Ethanaminium, N,N-Bis-(1-Methylethyl)-N-methyl-2-[(ethoxymethylphosphinyl)thio]-, Iodide	C01-A017
Ethanaminium, N,N-Bis(1-methylethyl)-N-methyl-2-[(ethoxymethylphosphinyl)thio]-, Iodide	C01-A017
Ethanaminium, N,N-Diethyl-N-methyl-2-[(cyclohexyloxymethylphosphinyl)thio]-, Iodide	C01-A021
Ethanaminium, N,N-Diethyl-N-methyl-2-[(ethoxymethylphosphinyl)thio]-, Iodide	C01-A015
Ethanaminium, N,N-Diisopropyl-N-methyl-2-[(ethoxymethylphosphinyl)thio]-, Iodide	C01-A017
Ethanaminium, N,N-Dimethyl-N-propyl-2-[(ethoxyethylphosphinyl)thio]-, Iodide	C01-A023
Ethanaminium, N-Ethyl-N,N-dimethyl-2-[(ethoxyethylphosphinyl)thio]-, Iodide	C01-A023
Ethanaminium, N-Ethyl-N,N-dimethyl-2-[(ethoxymethylphosphinyl)thio]-, Iodide	C01-A018
Ethane 1,2-Dithiol	C03-D048
Ethane Amine	C11-A068
Ethane Dichloride	C11-A070
Ethane, 1,1,2,2-Tetrabromo-	C11-A164
Ethane, 1,1,2,2-Tetrachloro-	C11-A165
Ethane, 1,1'-(Oxybis(methylenethio))bis(2-chloro-	C03-A015
Ethane, 1,1'-[Methylenebis(thio)]bis[2-chloro-	C03-A011
Ethane, 1,1'-Oxybis(2-chloro-	C11-A017
Ethane, 1,1'-Oxybis[2-[(2-chloroethyl)thio]-	C03-A003
Ethane, 1,1'-Sulfinylbis(2-chloro-	C03-D056
Ethane, 1,1'-Sulfonylbis(2-chloro-	C03-D055
Ethane, 1,1'-Thiobis(2-chloro-	C03-A001
Ethane, 1,2-Bis[(2-Chloroethyl)thio]-	C03-A002
Ethane, 1,2-Dibromo-	C11-A069
Ethane, 1-Chloro-2-[(chloromethyl)thio]-	C03-A008
Ethane, Dichloro-	C11-A070
Ethane, Tetrachloro-	C11-A165
Ethanedinitrile	C07-A005

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Ethanedithiol	C03-D048
Ethanephosphonic Acid Diethyl Ester	C01-C090
Ethanephosphonic Dichloride	C01-C094
Ethanephosphonothionodichloridic Acid	C01-C163
Ethanephosphonyl Chloride	C01-C094
Ethanethiol, 2-(Bis(1-methylethyl)amino)-	C01-C105
Ethanethiol, 2-(Diisopropylamino)-	C01-C105
Ethanethiophosphonodichloridic Acid	C01-C163
Ethanimidamide, N,N-diethyl-	C01-C107
Ethanimidamide, N,N-Dimethyl- {Novichok Precursor}	C01-C
Ethanimidamide, N,N-Propyl- {Novichok Precursor}	C01-C
Ethanimidothioic Acid, 2-(Dimethylamino)-N-[[(methylamino)carbonyl]oxy]-2-oxo-, Methyl Ester	C11-A147
Ethanimidothioic Acid, N-[[(Methylamino)carbonyl]oxy]-, Methyl Ester	C11-A107
Ethanimidoyl Chloride, 2,2-Dichloro-N-[(chloroethoxyphosphinyl)oxy]-	C01-C128
Ethanimidoyl Chloride, 2,2-Dichloro-N-[(dichlorophosphinyl)oxy]-	C01-C119
Ethanimidoyl Chloride, 2-Chloro-N-[(chloroethoxyphosphinyl)oxy]-	C01-C134
Ethanimidoyl Chloride, 2-Chloro-N-[(chloromethoxyphosphinyl)oxy]-	C01-C125
Ethanimidoyl Chloride, 2-Chloro-N-[(dichlorophosphinyl)oxy]-	C01-C114
Ethanimidoyl Chloride, 2-Chloro-N-[[chloro(2,2,3,3-tetrafluoropropoxy)phosphinyl]oxy]-	C01-C142
Ethanimidoyl Chloride, N-[(Chloroethoxyphosphinyl)oxy]-	C01-C138
Ethanimidoyl Chloride, N-[(Chloropropoxyphosphinyl)oxy]-	C01-C139
Ethanimidoyl Chloride, N-[(Dichlorophosphinyl)oxy]-	C01-C116
Ethanimidoyl Chloride, N-[[Chloro(1-methylethoxy)phosphinyl]oxy]-	C01-C140
Ethanimidoyl Chloride, N-[[Chloro(2-methylpropoxy)phosphinyl]oxy]-	C01-C145
Ethanimidoyl Fluoride, 2,2-Difluoro-N-[(fluoromethoxyphosphinyl)oxy]-2-nitro-	C01-A044
Ethanimidoyl Fluoride, N-[(Chloroethoxyphosphinyl)oxy]-2,2-difluoro-2-nitro-	C01-C127
Ethanimidoyl Fluoride, N-[(Chloromethoxyphosphinyl)oxy]-2,2-difluoro-2-nitro-	C01-C120
Ethanimidoyl Fluoride, N-[(Dichlorophosphinyl)oxy]-2,2-difluoro-2-nitro-	C01-C113
Ethanimidoyl Fluoride, N-[(Ethoxyfluorophosphinyl)oxy]-2,2-difluoro-2-nitro-	C01-A048
Ethanol, 2-(Diisopropylamino)-	C01-C104
Ethanol, 2,2'-(1,2-Ethanediylbis(thio))bis-	C03-D046
Ethanol, 2,2'-(Ethylenedithio)di-	C03-D046
Ethanol, 2,2'-(Ethylimino)bis-	C03-C044
Ethanol, 2,2'-(Ethylimino)di-	C03-C044
Ethanol, 2,2'-(Methylimino)bis-	C03-C043
Ethanol, 2,2'-(Methylimino)di-	C03-C043
Ethanol, 2,2',2"-Nitrilotri-	C03-C045
Ethanol, 2,2',2"-Nitrilotris-	C03-C045
Ethanol, 2,2'-Iminobis-	C03-D060
Ethanol, 2,2'-Iminodi-	C03-D060
Ethanol, 2,2'-Thiobis-	C03-C037
Ethanol, 2,2'-Thiodi-	C03-C037
Ethanol, 2-[Bis-(1-Methylethyl)amino]-	C01-C104
Ethanol, 2-Chloro-	C03-C041
Ethanol, 2-Chloro-, Hydrogen Phosphorochloridate O-[(Chlorofluoromethylene)amino] Derivative	C01-C121
Ethanol, 2-Chloro-, Hydrogen Phosphorofluoridate O-[(Chlorofluoromethylene)amino] Derivative	C01-A049
Ethanol, 2-Fluoro-	C11-A079
Ethanox	C11-A065
Ethene Chlorohydrin	C03-C041
Ethene Oxide	C11-A071

Ethene, [(2-Chloroethyl)sulfinyl]-	C03-D053
Ethene, [(2-Chloroethyl)sulfonyl]-	C03-D052
Ethene, [(2-Chloroethyl)thio]-	C03-D054
Ethene, 1,1'-Sulfinylbis-	C03-D050
Ethene, 1,1'-Sulfonylbis-	C03-D049
Ethene, 1,1'-Thiobis-	C03-D051
Ethene, 1-Chloro-1,2,2-trifluoro-	C11-A177
Ethene, Chloro-	C11-A180
Ethene, Chlorohydrin	C03-C041
Ethene, Chlorotrifluoro-	C11-A177
Ethenesulfonyl-ethene	C03-D049
Ethenol, 2,2-Dichloro-, Dimethyl Phosphate	C11-A055
Ethenone, Dimer	C11-A057
Ethenylsulfanylethene	C03-D051
Ether Cyanatus	C11-A142
Ether Dichlore	C11-A017
Ether Methylique Monochlore	C11-A044
Ether, Bis(2-chloroethyl)	C11-A017
Ether, Bis(bromomethyl)	C10-A012
Ether, Bis(chloroethyl)	C11-A017
Ether, Bis(chloromethyl)	C10-A011
Ether, Chloromethyl Methyl	C11-A044
Ether, Dimethyl Chloro	C11-A044
Ethiol	C11-A065
Ethlon	C11-A133
Ethodan	C11-A065
Ethopaz	C11-A065
Ethox	C11-A071
Ethoxy-(((4-nitrophenoxy)phenyl)phosphine) Sulfide	C11-A064
Ethoxy-(4-nitrophenoxy)-phenyl-sulfanylidene-λ5-phosphane	C11-A064
Ethoxy(ethylthio)(methyl)phosphine Oxide	C01-D169
Ethoxy-4-nitrophenoxyphenylphosphine Sulfide	C11-A064
Ethoxycarbonyl Chloride	C11-A066
Ethoxy-ethyl-(phenylthio)-sulfanylidenephosphorane	C11-A082
Ethoxy-ethyl-phenylsulfanyl-sulfanylidene-λ5-phosphane	C11-A082
Ethoxy-ethyl-sulfanylidene-(2,4,5-trichlorophenoxy)-λ5-phosphane	C11-A075
Ethoxy-hydroxy-methyl-sulfanylidene-λ5-phosphane	C01-C069
Ethoxyphosphonoyl Dichloride	C01-C160
Ethoxyphosphonoyl Dichloride	C01-C160
Ethoxyphosphonoyl Difluoride	C01-C160
Ethoxyphosphoryl Dichloride	C01-C160
Ethoxysulfonyl Chloride	C10-A010
Ethoxysulphonyl Chloride	C10-A010
Ethyamine	C11-A068
Ethyl (2-Diisopropylaminoethyl) Methylphosphonite	C01-C064
Ethyl (Ethylsulfanyl)(methyl)phosphinate	C01-D169
Ethyl (p-Nitrophenyl) Benzenethionophosphonate	C11-A064
Ethyl (p-Nitrophenyl) Benzenethiophosphate	C11-A064
Ethyl (p-Nitrophenyl) Benzenethiophosphonate	C11-A064

(*Continued*)

Ethyl (p-Nitrophenyl) Phenylphosphonothioate	C11-A064
Ethyl (p-Nitrophenyl) Thionobenzenephosphate	C11-A064
Ethyl (p-Nitrophenyl) Thionobenzenephosphonate	C11-A064
Ethyl [(1E)-1-(Diethylamino)ethylidene]phosphoramidofluoridate	C01-A038
Ethyl 2-(N,N-Diisopropylamino)ethyl Methylphosphonite	C01-C064
Ethyl 3-Methyl-4-(methylsulfanyl)phenyl (1-Methylethyl)amidophosphate	C11-A074
Ethyl 3-Methyl-4-(methylsulfanyl)phenyl Isopropylamidophosphate	C11-A074
Ethyl 3-Methyl-4-(methylsulfanyl)phenyl N-(Propan-2-yl)phosphoramidate	C11-A074
Ethyl 3-Methyl-4-(methylthio)phenyl (1-Methylethyl)phosphoramidate	C11-A074
Ethyl 3-Methyl-4-(methylthio)phenyl (Isopropyl)phosphoramidate	C11-A074
Ethyl 3-Methyl-4-(methylthio)phenyl 1-Methylethylphosphoramidate	C11-A074
Ethyl 3-Methyl-4-(methylthio)phenyl Isopropylamidophosphate	C11-A074
Ethyl 3-Methyl-4-(methylthio)phenyl Isopropylphosphoramidate	C11-A074
Ethyl 3-Methyl-4-(methylthio)phenyl-(1-methylethyl)phosphoramidate	C11-A074
Ethyl 3-Methyl-4-(methylthio)phenyl-(isopropyl)phosphoramidate	C11-A074
Ethyl 4-(Methylthio)-meta-tolyl Isopropylphosphoramidate	C11-A074
Ethyl 4-Methylthio-m-tolyl Isopropylphosphoramidate	C11-A074
Ethyl 4-Nitrophenyl Ethoxy(sulfanylidene)phosphonite	C11-A133
Ethyl Amine	C11-A068
Ethyl Bicyclic Phosphate	C06-A002
Ethyl Bromophos	C11-A025
Ethyl Carbonochloridate	C11-A066
Ethyl Carbophenothion	C11-A036
Ethyl Chioroformate	C11-A066
Ethyl Chlorcarbonate	C11-A066
Ethyl Chlorformate	C11-A066
Ethyl Chloridocarbonate	C11-A066
Ethyl Chlorocarbonate	C11-A066
Ethyl Chlorofluorophosphate {Novichok Precursor}	C01-C
Ethyl Chloroformate	C11-A066
Ethyl Chloromethanoate	C11-A066
Ethyl Chlorophosphite	C01-C159
Ethyl Chlorosulfate	C10-A010
Ethyl Chlorosulfonate	C10-A010
Ethyl Chlorosulphate	C10-A010
Ethyl Chlorosulphonate	C10-A010
Ethyl Chlorothioformate	C11-A067
Ethyl Chlorothiolformate	C11-A067
Ethyl Chlorothioloformate	C11-A067
Ethyl Chlorsulfonate	C10-A010
Ethyl Chlorsulphonate	C10-A010
Ethyl Choroformate	C11-A066
Ethyl Cloroformate	C11-A066
Ethyl Cyanide	C11-A041
Ethyl Cyanide	C11-A142
Ethyl Dichloridophosphate	C01-C160
Ethyl Dichloroarsine	C04-A001
Ethyl Dichlorophosphate	C01-C160
Ethyl Dichlorophosphinate	C01-C160
Ethyl Dick	C04-A001

Ethyl Diethanolamine	C03-C044
Ethyl Difluoridophosphate	C01-C160
Ethyl Difluorophosphate	C01-C160
Ethyl Difluorophosphite	C01-C
Ethyl Dimethylamidocyanophosphate	C01-A001
Ethyl Dimethylamidofluorophosphate	C01-A013
Ethyl Dimethylaminocyanophosphonate	C01-A001
Ethyl Dimethylphosphoramide Cyanidate	C01-A001
Ethyl Dimethylphosphoramidocyanidate	C01-A001
Ethyl Ester of Dimethylphosphoroamidocyanidic Acid	C01-A001
Ethyl Ethylphosphonofluoridate	C01-A010
Ethyl Ethylphosphonofluoridoate	C01-A010
Ethyl Hydrogen Methylphosphonate	C01-D168
Ethyl Methylene Phosphorodithioate	C11-A065
Ethyl Methylphosphonate	C01-D168
Ethyl Methylphosphonic Acid	C01-D168
Ethyl Methylphosphonofluoridate	C01-A011
Ethyl Methylphosphonofluoride	C01-A011
Ethyl Methylphosphonofluoridoate	C01-A011
Ethyl Methylphosphonothioic Acid	C01-C069
Ethyl N,N'-Dimethylphosphoroamidocyanidate	C01-A001
Ethyl N,N-Dimethylphosphoramidocyanidate	C01-A001
Ethyl N-[(1E)-1-(Diethylamino)ethylidene]-phosphoramidofluoridate	C01-A038
Ethyl N-[1-(Diethylamino)ethylidene]phosphoramidofluoridate	C01-A038
Ethyl N-Dimethylphosphoramidocyanidate	C01-A001
Ethyl O-(2,4,5-Trichlorophenyl) Ethylphosphonothioate	C11-A075
Ethyl para-Nitrophenyl Benzenethiophosphonate	C11-A064
Ethyl Parathion	C11-A133
Ethyl Phosphate	C01-D173
Ethyl Phosphate	C01-D175
Ethyl Phosphinyl Dichloride	C01-C093
Ethyl Phosphinyl Difluoride	C01-C
Ethyl Phosphite	C01-C087
Ethyl Phosphite	C01-C088
Ethyl Phosphonate	C01-C087
Ethyl Phosphonic Dichloride	C01-C094
Ethyl Phosphonothioic Dichloride	C01-C163
Ethyl Phosphonothioyl Dichloride	C01-C163
Ethyl Phosphonous Dichloride	C01-C093
Ethyl Phosphonyl Dichloride	C01-C094
Ethyl Phosphonyl Difluoride	C01-C
Ethyl Phosphorochloridite	C01-C159
Ethyl Phosphorochloridofluoridate {Novichok Precursor}	C01-C
Ethyl Phosphorodichloridate	C01-C160
Ethyl Phosphorodichloride	C01-C094
Ethyl Phosphorodifluoridate	C01-C160
Ethyl Phosphorodimethylamidocyanidate	C01-A001
Ethyl Phosphorus Dichloride	C01-C094
Ethyl Phosphoryl Dichloride	C01-C160

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Ethyl Pyrophosphate	C11-A167
Ethyl Pyrophosphate, Tetra-	C11-A167
Ethyl S	C03-A016
Ethyl S-[2-(Bis-(1-Methylethyl)amino)ethyl] Methylphosphonothiolate, Hydrochloride	C01-A017
Ethyl S-[2-(Bis(1-methylethyl)amino)ethyl] Methylphosphonothiolate, Hydrochloride	C01-A017
Ethyl S-[2-(Bis(isopropyl)amino)ethyl] Methylphosphonothiolate, Hydrochloride	C01-A017
Ethyl S-2-Diethylaminoethyl Isopropylphosphonothiolate	C01-A025
Ethyl S-2-Diethylaminoethyl Methylphosphonothiolate	C01-A015
Ethyl S-2-Diethylaminoethyl Propylphosphonothiolate	C01-A026
Ethyl S-2-Diisopropylaminoethyl Methylphosphonothiolate	C01-A017
Ethyl S-2-Diisopropylaminoethyl Methylphosphonothiolate, Hydrochloride	C01-A017
Ethyl S-2-Dimethylaminoethyl Ethylphosphonothiolate	C01-A023
Ethyl S-2-Dimethylaminoethyl Methylphosphonothioate	C01-A018
Ethyl S-2-Dimethylaminoethyl Methylphosphonothiolate	C01-A018
Ethyl Sarin	C01-A004
Ethyl S-Phenyl Ethylphosphonodithioate	C11-A082
Ethyl S-Phenyl Ethylphosphonothiolthionate	C11-A082
Ethyl Sulfurochloridate	C10-A010
Ethyl Systox	C11-A050
Ethyl Thio	C11-A161
Ethyl Thiochloroformate	C11-A067
Ethyl Thiolchloroformate	C11-A067
Ethyl Thiometon	C11-A062
Ethyl Thiopyrophosphate	C11-A161
Ethyl Trichlorophenylethylphosphonothioate	C11-A075
Ethyl-(1-(diethylamino)ethylidene)phosphoramidofluoridate	C01-A038
Ethyl-[(1E)-1-(diethylamino)ethyliden]phosphoramidofluoridat	C01-A038
Ethyl-3-methyl-4-(methylthio)phenyl(1-methylethyl)phosphoramidate	C11-A074
Ethyl-3-methyl-4-(methylthio)phenyl(isopropyl)phosphoramidate	C11-A074
Ethyl-4-(methylthio)-meta-tolyl Isopropylphosphoramidate	C11-A074
Ethyl-4-(methylthio)-m-tolyl Isopropylphosphoramidate	C11-A074
Ethylamin	C11-A068
Ethylamine	C11-A068
Ethylamine, Bis(2-hydroxyethyl)-	C03-C044
Ethylamine, N-Chloro-1-methyl-	C01-D172
Ethylarsonous Dichloride	C04-A001
Ethylbicyclophosphate	C06-A002
Ethylbis(2-chloroethyl)amine	C03-A016
Ethylbis(2-chloroethyl)amine Hydrochloride	C03-A016
Ethylbis(2-hydroxyethyl)amine	C03-C044
Ethyl-bis-(2-hydroxy-ethyl)-amine	C03-C044
Ethylbis(beta-chloroethyl)amine	C03-A016
Ethylbis(β-chloroethyl)amine	C03-A016
Ethylchloorformiaat	C11-A066
Ethylchlorocarbanate	C11-A066
Ethylchlorocarbonate	C11-A066
Ethylchloroformate	C11-A066
Ethylchlorohydrin	C03-C041
Ethylchorocarbonate	C11-A066
Ethylcloroformate	C11-A066

Ethyl-d5 Methylphosphonofluoridate	C01-A011
Ethyl-d5 S-2-Diisopropylaminoethyl Methylphosphonothiolate	C01-A017
Ethyldichlorarsine	C04-A001
Ethyldichloroarsine	C04-A001
Ethyldichlorophosphate	C01-C160
Ethyldichlorophosphine	C01-C093
Ethyldichlorophosphite	C01-C094
Ethyldichlorophospine	C01-C093
Ethyldiethanolamine	C03-C044
Ethyldiethoxyphosphine Oxide	C01-C090
Ethyldifluorophosphate	C01-C160
Ethyldifluorophosphine	C01-C
Ethyldifluorophosphine Oxide	C01-C
Ethyldiisopropylamine	C01-D176
Ethyldimethylaminocyanophosphonate	C01-A001
Ethyle, Chloroformiat d'	C11-A066
Ethyleen-chloorhydrine	C03-C041
Ethyleendichloride	C11-A070
Ethyleenimine	C11-A072
Ethyleenoxide	C11-A071
Ethylenchlorid	C11-A180
Ethylendichloride	C11-A070
Ethylene (Oxyde d')	C11-A071
Ethylene Bis-beta-chloroethylsulfide	C03-A002
Ethylene Bis-β-chloroethylsulfide	C03-A002
Ethylene Bromide	C11-A069
Ethylene Chlorhydrin	C03-C041
Ethylene Chloride	C11-A070
Ethylene Chlorohydrin	C03-C041
Ethylene Dibromide	C11-A069
Ethylene Dichloride	C11-A070
Ethylene Dichoride	C11-A070
Ethylene Dimercaptan	C03-D048
Ethylene Dithioglycol	C03-D048
Ethylene Episulfide	C03-D047
Ethylene Episulphide	C03-D047
Ethylene Fluorhydrin	C11-A079
Ethylene Fluorohydrin	C11-A079
Ethylene Fluorophosphite	C01-C156
Ethylene Glycol, Chlorohydrin	C03-C041
Ethylene Glycol, Dithio-	C03-D048
Ethylene Mercaptan	C03-D048
Ethylene Monochloride	C11-A180
Ethylene Phosphorofluoridite	C01-C156
Ethylene Sulfide	C03-D047
Ethylene Sulphide	C03-D047
Ethylene Tetrachloride	C11-A136
Ethylene, 1-Formyl-2-methyl-, cis-	C11-A047
Ethylene, 1-Formyl-2-methyl-, trans-	C11-A047

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Ethylene, Chloro-	C11-A180
Ethylene, Chlorotrifluoro-	C11-A177
Ethylene, Trifluorochloro-	C11-A177
Ethylenechloride	C11-A070
Ethylenedimercaptan	C03-D048
Ethylenedithiodiethanol	C03-D046
Ethylenedithioethanol	C03-D046
Ethylenedithiol	C03-D048
Ethyleneimine	C11-A072
Ethyleneoxy	C11-A071
Ethylenimine	C11-A072
Ethylenoxide	C11-A071
Ethylentetrachlorid	C11-A136
Ethylester Kyseliny Chlormravenci	C11-A066
Ethylesterdichlorid	C01-C160
Ethylester-Dimethylamid Kyseliny Kyanfosfonove	C01-A001
Ethylimine	C11-A072
Ethylkyanid	C11-A142
Ethylmercuric Chloride	C11-A073
Ethylmercury Chloride	C11-A073
Ethylmercury(II) Chloride	C11-A073
Ethylmerkurichlorid	C11-A073
Ethylmethylphosphonylchlorothionate	C01-C
Ethyl-N,N-diisopropylamine	C01-D176
Ethyl-N-dimethylphosphoramidocyanidate	C01-A001
Ethylphosphinyl Dichloride	C01-C093
Ethylphosphinyl Difluoride	C01-C
Ethylphosphonic Acid Dichloride	C01-C094
Ethylphosphonic Dichloride	C01-C094
Ethylphosphonic Difluoride	C01-C
Ethylphosphonodithioic Acid O-Ethyl S-Phenyl Ester	C11-A082
Ethylphosphonothioic Acid O-Ethyl O-(2,4,5-Trichlorophenyl) Ester	C11-A075
Ethylphosphonothioic Dichloride	C01-C163
Ethylphosphonothionic Dichloride	C01-C163
Ethylphosphonous Dichloride	C01-C093
Ethylphosphonous Difluoride	C01-C
Ethylphosphonyl Dichloride	C01-C094
Ethylphosphonyl Difluoride	C01-C
Ethylphosphonyldifluoride	C01-C
Ethylphosphoric Acid Dichloride	C01-C160
Ethylphosphoric Dichloride	C01-C094
Ethylphosphorodichloridate	C01-C160
Ethylphosphorodimethylamidocyanidate Ethyl Ester	C01-A001
Ethylphosphorus Dichloride	C01-C093
Ethylphosphoryl Dichloride	C01-C094
Ethyl-S	C03-A016
Ethyl-S-diisopropylaminoethyl Methylthiophosphonate	C01-A017
Ethyl-S-dimethylaminoethyl Methylphosphonothiolate	C01-A017
Ethylsulfuryl Chloride	C10-A010
Ethylsulphuryl Chloride	C10-A010

Ethylthiocarbonyl Chloride	C11-A067
Ethylthioethene	C03-D051
Ethylthiol Chloroformate	C11-A067
Ethylthionophosphonyl Dichloride	C01-C163
Ethylthiophosphonic Acid Dichloride	C01-C163
Ethylthiophosphonic Dichloride	C01-C163
Ethylthiopyrofosfaat	C11-A161
Etil Clorocarbonato	C11-A066
Etil Cloroformiato	C11-A066
Etilamina	C11-A068
Etilene (Ossido di)	C11-A071
Etilenimina	C11-A072
Etilon	C11-A133
ETO	C11-A071
Etylenu Tlenek	C11-A071
Etyloamina	C11-A068
Etylparation	C11-A133
EU9800000	C11-A030
EV1925000 {Cadmium Monoxide}	C11-A030
EV1930000 {Fume}	C11-A030
Eve	C03-C043
Everamine	C11-A072
Evercyn	C07-A001
EW0700000	C07-C007
Exhaust Gas	C09-A001
Exodin	C11-A051
Extrema	C11-A166
EZ Flow	C11-A038
- F -	
[(Fluoromethoxyphosphinyl)oxy]carbonimidic Chloride Fluoride	C01-A042
[(Fluoromethoxyphosphinyl)oxy]carbonimidic Dichloride	C01-A041
[(Fluoromethoxyphosphinyl)oxy]carbonimidic Difluoride	C01-A043
F	C10-A003
F-4	C11-A139
F-10	C11-A157
F 11	C11-A081
F 1140	C11-A180
F 11B	C11-A081
F1-Tabs	C01-C077
FAA	C11-A077
FAA	C11-A078
Fagin	C11-A178
FAH	C11-A078
Fampridina	C11-A008
Fampridine	C11-A008
Fampridinum	C11-A008
Fampyra	C11-A008
Fanfare	C11-A016
Fannoform	C11-A083

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FB9450000	C11-A032
FC 11	C11-A081
FC3150000	C11-A143
FC5775000	C11-A106
FCH2410211	C01-C055
FDA	C04-A004
FDA 0101	C01-C077
Fecama	C11-A055
Fekama	C11-A055
FEMA No. 2433	C11-A071
FEMA No. 2716	C11-A118
FEMA No. 2908	C11-A141
FEMA No. 3039	C11-A154
FEMA No. 3241	C11-A178
Femma	C11-A137
Fenamiphos	C11-A074
Fenildicloroarsina	C04-A004
Fenilidicloroarsina	C04-A004
Fenilživin Acetat	C11-A137
Fenophosphon	C11-A075
Fenyldichlorarsin	C04-A004
Fenylkwik(II)ethanoaat	C11-A137
Fenylkwikacetaat	C11-A137
Fenylmercuriacetat	C11-A137
Fenylmerkuriacetat	C11-A137
Fenyylielohopea-asetaatti	C11-A137
FER Pentacarbonyle	C09-A002
Fezudin	C11-A051
FF2160000	C01-C056
FF2175000	C01-C058
FF6650000	C11-A033
FG3500000	C09-A001
FG3675000	C11-A111
FG3855000	C11-A067
FG6125000	C11-A034
FG6400000	C11-A035
F-Gen	C11-A083
Ficam	C11-A014
Filariol	C11-A025
Filitox	C11-A103
Fisons	C11-A014
Fisons NC 2964	C11-A105
Fitosol	C11-A075
FKW 11	C11-A081
Flammon	C01-C080
Floridine	C01-C077
Florocide	C01-C077
Flour Sulfur	C01-C061
Flowers of Sulfur	C01-C061
Flozenges	C01-C077

Flridine	C01-C077
Fludent	C01-C077
Flue Gas	C09-A001
Flue Gasnide	C09-A001
Fluoboric Acid	C11-A169
Fluon 11	C11-A081
Fluophosgene	C11-A034
Fluophosphoric Acid di(Dimethylamide)	C11-A058
Fluor	C11-A076
Fluoracetamide	C11-A077
Fluoracetát Sodný	C11-A152
Fluoracetato de Sódio	C11-A152
Fluoracetic Acid Methyl Ester	C11-A114
Fluorakil	C11-A077
Fluorakil 3	C11-A152
Fluoral	C01-C077
Fluorane	C11-A089
Fluorättiksyra	C11-A078
Fluorazijnzuur	C11-A078
Fluorazijnzuur Natriumzout	C11-A152
Fluorboorzuur	C11-A169
Fluorboric Acid	C11-A169
Fluorborsäure	C11-A169
Fluorek N-[(Chloroetoksyfosfinylo)oksy]-2,2-difluoro-2-nitroetanoimidoilu	C01-C127
Fluorek N-[(Chlorometoksyfosfinylo)oksy]-2,2-difluoro-2-nitroetanoimidoilu	C01-C120
Fluorek N-[(Dichlorofosfinylo)oksy]-2,2-difluoro-2-nitroetanoimidoilu	C01-C113
Fluorek N-[(Etoksyfluorofosfinylo)oksy]-2,2-difluoro-2-nitroetanoimidoilu	C01-A048
Fluorek Siarki(IV)	C11-A155
Fluoressigaeure	C11-A152
Fluoressigsaeure	C11-A152
Fluoressigsäure	C11-A078
Fluoressigsäure-natriumsalz	C11-A152
Fluorethaanzuur	C11-A078
Fluorethanoát Sodný	C11-A152
Fluorethansäure	C11-A078
Fluoreto de Selênio	C11-A149
Fluorid Dusitý	C11-A129
Fluorid Fosforečný	C11-A140
Fluorid Křemičitý	C11-A150
Fluorid Selenový	C11-A149
Fluorid Sodny	C01-C077
Fluoride, Sodium	C01-C077
Fluoridohydrogen	C11-A089
Fluorine	C11-A076
Fluorine Hydride	C11-A089
Fluorine Monohydride	C11-A089
Fluorisopropoxymethylphosphine Oxide	C01-A002
Fluorkill	C11-A077
Fluoro	C11-A076

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Fluoro Acid Air	C11-A150
Fluoro de Sulfurilo	C11-A160
Fluoro HN2	C03-A019
Fluoro HN3	C03-A024
Fluoroacetamine	C11-A077
Fluoroacetate	C11-A078
Fluoroacetate de Sodium	C11-A152
Fluoroacetato de Sodio	C11-A152
Fluoroacetato di Sodio	C11-A152
Fluoroacetic	C11-A078
Fluoroacetic Acid	C11-A078
Fluoroacetic Acid 2-Fluoroethyl Ester	C11-A080
Fluoro-acetic Acid 2-Fluoro-ethyl Ester	C11-A080
Fluoroacetic Acid Amide	C11-A077
Fluoroacetic Acid Methyl Ester	C11-A114
Fluoroacetic Acid Sodium Salt	C11-A152
Fluoro-aceticaci	C11-A078
Fluoroaceticacid	C11-A078
Fluoro-aceticacisodiumsalt	C11-A152
Fluoroboric Acid	C11-A169
Fluoroborna Kiselina	C11-A169
Fluoroborova Kislina	C11-A169
Fluorocarbon 11	C11-A081
Fluorochloroform	C11-A081
Fluoroctan Sodny	C11-A152
Fluorodichloronitrosomethane	C01-C155
Fluorodusík	C11-A129
Fluoroethanoic Acid	C11-A078
Fluoroethanol	C11-A079
Fluoroethyl Alcohol	C11-A079
Fluoroformyl Fluoride	C11-A034
Fluoromethylphosphonic Acid	C01-D
Fluoromethylpinacolyloxyphosphine Oxide	C01-A003
Fluorooctan Sodu	C11-A152
Fluorophosgene	C11-A034
Fluorophosphoric Acid di(Dimethylamide)	C11-A058
Fluoroplast 3	C11-A177
Fluoros	C01-C077
Fluorosilicate de Sodium	C01-C106
Fluorotabun	C01-A013
Fluorotrichloromethane	C11-A081
Fluorotrojchlorometan	C11-A081
Fluorowodor	C11-A089
Fluorum	C11-A089
Fluorur de Sulfuril	C11-A160
Fluorură de Sulf(IV)	C11-A155
Fluorure D'hydrogene	C11-A089
Fluorure D'hydrogene Anhydre	C11-A089
Fluorure de Bore	C11-A022
Fluorure de Germanium(IV)	C11-A084

Fluorure de N,N,N',N'-Tetramethyle phosphoro-diamide	C11-A058
Fluorure de Potassium	C01-C076
Fluorure de Sodium	C01-C077
Fluorure de Sulfuryle	C11-A160
Fluorure de Tellure(VI)	C11-A162
Fluorures Acide	C11-A076
Fluoruri Acidi	C11-A076
Fluoruro de Azufre(IV)	C11-A155
Fluoruro de Fósforo (V)	C11-A140
Fluoruro de Germanio (IV)	C11-A084
Fluoruro de Hidrogeno Anhidro	C11-A089
Fluoruro de Selenio(VI)	C11-A149
Fluoruro de Wolframio(VI)	C11-A179
Fluoruro di Azoto	C11-A129
Fluoruro di Selenio(VI)	C11-A149
Fluoruro di Silicio(IV)	C11-A150
Fluoruro di Tungsteno(VI)	C11-A179
Fluorwasserstoff	C11-A089
Fluorwaterstof	C11-A089
Fluorzoin	C01-C077
Fluosilicate de Sodium	C01-C106
Flura	C01-C077
Flutritex 2	C11-A079
Flux	C01-C077
Fly Bait Grits	C11-A018
Fly Fighter	C11-A055
Fly-Die	C11-A055
Flytek	C11-A107
Flytrol	C11-A051
FM	C11-A172
FM 511	C01-A001
FMA	C11-A137
FMC 10242	C11-A032
FMC 54800	C11-A016
FO2100000	C10-A001
FO2800000	C10-A015
FO2975000	C11-A039
FO3000000	C11-A038
Folidol	C11-A133
Folidol 600	C11-A120
Folidol M	C11-A120
Folimat	C11-A131
Fomanđêhít	C11-A083
Fonofos	C11-A082
Fonophos	C11-A082
Foraat	C11-A138
Forate	C11-A138
Fordor	C11-A083
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Forestite	C07-A001
Formagene	C11-A083
Formaldehído	C11-A083
Formaldehyd	C11-A083
Formaldehyde	C11-A083
Formaldeide	C11-A083
Formaldoxime Dibromide	C05-A002
Formalin	C11-A083
Formalina	C11-A083
Formaline	C11-A083
Formalin-loesungen	C11-A083
Formalith	C11-A083
Formiate de Methyle	C11-A115
Formiato de Metila	C11-A115
Formiato di Metile	C11-A115
Formic Acid, Chloro-, Allyl Ester	C11-A006
Formic Acid, Chloro-, Butyl Ester	C11-A026
Formic Acid, Chloro-, Ethyl Ester	C11-A066
Formic Acid, Chloro-, Isobutyl Ester	C11-A092
Formic Acid, Chloro-, Isopropyl Ester	C11-A093
Formic Acid, Chloro-, Methyl Ester	C11-A111
Formic Acid, Chloro-, Propyl Ester	C11-A144
Formic Acid, Chloro-, s-Butyl Ester	C11-A027
Formic Acid, Chloro-, sec-Butyl Ester	C11-A027
Formic Acid, Chloro-, Trichloromethyl Ester	C10-A004
Formic Acid, Chlorothio-, S-Ethyl Ester	C11-A067
Formic Acid, Methyl Ester	C11-A115
Formic Aldehyde	C11-A083
Formic Anammonide	C07-A001
Formol	C11-A083
Formolo	C11-A083
Formonitrile	C07-A001
Formyl Trichloride	C11-A043
Formylhydrat	C11-A083
Fosdrin	C11-A123
Fosfaan	C11-A139
Fosfamin	C11-A139
Fosfamina	C11-A139
Fosfan	C11-A139
Fosfano	C11-A139
Fosfatox E	C11-A065
Fosfermo	C11-A133
Fosferno	C11-A133
Fosfex	C11-A133
Fosfin	C11-A139
Fosfin Trihydride	C11-A139
Fosfina	C11-A139
Fosfinov Vodik	C11-A139
Fosfive	C11-A133
Fosfono 50	C11-A065

Fosfor Pentafluoride	C11-A140
Fosfor Trihidrid	C11-A139
Fosfor(V)fluoride	C11-A140
Fosforerat Väte	C11-A139
Fosforirani Vodik	C11-A139
Fosforjev Hidrid	C11-A139
Fosforo(pentacloruro di)	C01-C082
Fosforo(tricloruro di)	C01-C081
Fosforowodor	C11-A139
Fosforoxychlorid	C01-C083
Fosforpentachloride	C01-C082
Fosforpentafluoride	C11-A140
Fosforthiochlorid	C01-C075
Fosfortrichloride	C01-C081
Fosfortrihydrid	C11-A139
Fosforus Pentafluorida	C11-A140
Fosforwaterstof	C11-A139
Fosforyn Trojetylowy	C01-C088
Fosforyn Trojmetylowy	C01-C086
Fosfuro di Idrogeno	C11-A139
Fosgeen	C10-A003
Fosgen	C10-A003
Fosgen Oksim	C05-A001
Fosgene	C10-A003
Fosgeno	C10-A003
Fosova	C11-A133
Fostern	C11-A133
Fostox	C11-A133
Fosvex	C11-A167
Fozgen	C10-A003
Frampridine	C11-A008
Fratol	C11-A152
Fraude's Reagent	C11-A135
French Green	C11-A046
Freon 11	C11-A081
Freon 20	C11-A043
Freon 150	C11-A070
Freon 1110	C11-A136
Freon 1113	C11-A177
Freon HE	C11-A081
Freon MF	C11-A081
Frigen 11	C11-A081
Frigen 1140	C11-A180
Frigen S 11	C11-A081
Frumin	C11-A062
FS9100000	C11-A043
F-Stoff	C11-A172
FT-0632820	C01-C058
Fuam	C11-A014

(*Continued*)

Fulex	C11-A161
Fumagon	C11-A053
Fumazone	C11-A053
Fumergerite	C11-A172
Fumic Acid	C11-A126
Fumigerite	C11-A172
Fumigrain	C11-A002
Fuming Liquid Arsenic	C04-C006
Fuming Nitric Acid	C11-A126
Fuming Sulfuric Acid	C11-A157
Fumitoxin {Aluminum Phosphide}	C11-A139
Fumo-gas	C11-A069
Fungchex	C11-A096
Fungicide R	C11-A137
Fungifen	C11-A134
Fungitox	C11-A137
Fungol B	C01-C077
Fuoros	C01-C077
Furacarb	C11-A032
Furadan	C11-A032
Furatol	C11-A152
Furodan	C11-A032
Fussol	C11-A077
Fyde	C11-A083
Fyrol DMMP	C01-C059
Fyrol DMMP	C11-A082

- G -

G1	C10-A003
G-7	C08-A001
G8	C10-A006
G-10	C04-C006
G10	C07-A001
G-25	C10-A006
G-28	C10-A001
G-31	C09-A001
G-34	C03-A001
G34	C04-A002
G-37	C03-A009
G-43	C07-A001
G-49	C10-A004
G-52	C10-A003
G-55	C10-A014
G-67	C07-A002
G-73	C10-A013
G-79	C11-A066
G-133 {Cyanogen Chloride and Titanium Tetrachloride Mixture}	C07-A003
G-145	C09-A003
G-148	C11-A156
G-151	C10-A009
G-175	C10-A012

G-178	C07-A003
G-181	C11-A012
G-184	C07-C009
G-190	C11-A111
G-193	C11-A041
G-199	C11-A089
G-202	C11-A044
G-220	C11-A007
G-229	C11-A004
G-235	C10-A011
G-256	C11-A091
G-298	C11-A175
G-307	C11-A047
G-313	C04-A003
G-319	C04-A001
G-334	C11-A030
G-346 {Hydrogen Cyanide and Hydrogen Chloride Mixture}	C07-A
G-349	C04-A004
G-352	C11-A005
G-355	C03-D
G-385	C04-A003
GA	C01-A001
Galesan	C11-A051
Gallotox	C11-A137
Galokson	C11-A132
Galpar	C11-A133
gamma Lewisit	C04-C007
gamma-Aminopyridine	C11-A008
gamma-Chlorisobutylen	C11-A102
gamma-Chloroethanol	C03-C041
gamma-Chloroisobutylene	C11-A102
gamma-Methylenepropiolactone	C11-A057
gamma-Pyridylamine	C11-A008
Ganozan	C11-A073
Garden Dowfume	C11-A069
Garden Tox	C11-A051
Garrathion	C11-A036
Garvox	C11-A014
Gas Hidrohlorne	C11-A088
Gas-Ex-B	C11-A139
Gastion {Aluminum Phosphide}	C11-A139
Gastoxin {Aluminum Phosphide}	C11-A139
GB	C01-A002
GB2 {Binary}	C01-A002
GB-PRO {Sarin (92%) and Tributylamine Mixture}	C01-A002
GB-RD {Distilled GB-RO}	C01-A002
GB-RO	C01-A002
GB-RS {Distilled GB-RO and Diisopropylcarbodiimide Mixture}	C01-A002
GC 7887	C11-A086

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GD	C01-A003
GD2 {Binary}	C01-A003
GD-42	C01-A015
GE	C01-A004
Gearphos	C11-A133
Gecmani Tetraflorua	C11-A084
Geigy 13005	C11-A105
Gelan	C01-A001
Gelan I	C01-A001
Gelan III	C01-A002
Gelbes Präzipitat	C11-A098
Gelbes Quecksilberoxyd	C11-A098
Gelbkreuz (Yellow Cross – German WWI Shell)	C03-A001
Gelbkreuz 1 (Yellow Cross 1 – German WWI Shell) {Bis(chloromethyl) Ether (95-50%) and Ethyldichloroarsine (5-50%) Mixture}	C10-A
Gelbring 1 (Yellow Ring 1 – German WWI Shell)	C03-A001
Gelbring 2 (Yellow Ring 2 – German WWI Shell)	C03-A001
Gelution	C01-C077
Genetron 11	C11-A081
Genetron 1113	C11-A177
Genithion	C11-A133
Genuine Paris Green	C11-A046
GEO-00992	C01-C065
Geomet	C11-A138
German Stuff	C03-A001
Germane, Tetrafluoro-	C11-A084
Germanium (IV) Fluoride	C11-A084
Germanium Fluoride	C11-A084
Germanium Tetrafluorida	C11-A084
Germanium Tetrafluoride	C11-A084
Germanium(IV) Fluoride	C11-A084
Germanium(IV) Tetrafluoride	C11-A084
Germanium(IV)-fluorid	C11-A084
Germaniumtetrafluorid	C11-A084
Germyl Tetrafluoride	C11-A084
Gesfid	C11-A123
Gestid	C11-A123
GF	C01-A005
GF Acid	C01-C072
Gifblaar Poison	C11-A078
Gifblaar Poison	C11-A152
Gift 1080	C11-A152
Giftblaar Poison	C11-A152
GL6475000	C11-A046
Glazd Penta	C11-A134
Glebofos	C11-A062
Glicol Monocloridrina	C03-C041
Glore Phos 36	C11-A125
Glutaconic Acid, 3-Hydroxy-, Dimethyl Ester, Dimethyl Phosphate	C11-A018
Glycol Bromide	C11-A069

Glycol Chlorohydrin	C03-C041
Glycol Dibromide	C11-A069
Glycol Dichloride	C11-A070
Glycol Monochlorohydrin	C03-C041
Glycolfluorohydrin	C11-A079
Glycolmonochloorhydrine	C03-C041
Glycomonochlorhydrin	C03-C041
Glycomonochlorohydrin	C03-C041
Glyecine A	C03-C037
Gofrativ	C01-C061
Golden Dew	C01-C061
Goldenleaf Tobacco Spray	C11-A063
Goldquat 276	C11-A132
Gopher Bait	C11-A159
Gopher-gitter	C11-A159
Gothnion	C11-A013
GP	C01-A006
GP	C01-A029
GP9499000	C11-A047
GQ5250000	C11-A123
Gramixel	C11-A132
Gramoxone	C11-A132
Gramuron	C11-A132
Grandslam	C11-A106
Granosan	C11-A070
Granosan	C11-A073
Granozan	C11-A073
Granutox	C11-A138
Graphlox	C11-A085
Green Cross (German WWI Shell)	C10-A003
Green Cross (German WWI Shell)	C10-A004
Green Cross 2 (German WWI Shell) {Phosgene (60%), Diphosgene (30%) and Diphenylchloroarsine (10%) Mixture}	C10-A
Green Cross 3 (German WWI Shell) {Ethyldichloroarsine and Ethyldibromoarsine Mixture}	C04-A001
Green Cross Agents	C10-A
Green Cross Gas	C11-A175
Green Cross No. 1 (German WWI Shell) {Diphosgene with or without Chloropicrin and/or Bromomethylethyl Ketone Mixture}	C10-A
Green Cross No. 2 (German WWI Shell) {Phosgene (60%), Diphosgene (30%) and Diphenylchloroarsine (10%) Mixture}	C10-A
Green Ring 1 (German WWII Shell)	C03-A018
Green Ring 2 (German WWI Shell)	C10-A003
Green Ring 3 (German WWII Shell)	C01-A001
Green Ring 4 (German WWII Shell)	C01-A002
Green Ring 5 (German WWI Shell)	C07-A001
Green Star (British WWI Cylinder Gas) {Chloropicrin (65%) and Hydrogen Sulfide (35%) Mixture}	C10-A
Grisol	C11-A167
Gro-Tone Nematode	C11-A053
Grün 1	C10-A003

(*Continued*)

Grün 3	C01-A003
Grundier Arbezol	C11-A134
Grünkreuz (German WWI Shell)	C10-A003
Grünkreuz (German WWI Shell)	C10-A004
Grünkreuz 1 (German WWI Shell) {Phenylcarbylamine Chloride and Halogenated Ketones Mixture}	C10-A
Grünkreuz 2 (German WWI Shell) {Phosgene (60%), Diphosgene (30%) and Diphenylchloroarsine (10%) Mixture}	C10-A
Grünkreuz 3 (German WWI Shell) {Phenylcarbylamine Chloride and Halogenated Ketones Mixture}	C10-A
Grünkreuz 3 (Green Cross 3 - German WWI Shell) {Ethyldichloroarsine and Ethyldibromoarsine Mixture}	C04-A001
Grünring 1 (German WWII Shell)	C03-A018
Grünring 2 (German WWI Shell)	C10-A003
Grünring 3 (German WWII Shell)	C01-A001
Grünring 4 (German WWII Shell)	C01-A002
Grünring 5 (German WWI Shell)	C07-A001
GS 13005	C11-A105
GT 23	C01-A
GT1925000	C07-A005
GT2100000	C07-A002
GT2275000	C07-A003
Guanidine, Cyano(methylmercurio)-	C11-A119
Guanidine, N,N,N',N'-tetraethyl-	C01-C108
Gusathion	C11-A013
Gusathion Methyl	C11-A013
Guthion	C11-A013
Gution	C11-A013
GV	C01-A029
GV1	C01-A030
GV2	C01-A031
GV3	C01-A032
GV4	C01-A033
GV5	C01-A034
GX0700000	C11-A048
GY1225000	C11-A085
GZ1233000	C11-A049

- H -

H (Levinstein Mustard)	C03-A001
H 321	C11-A106
H Sulfone	C03-D055
H Sulfoxide	C03-D056
H(SC) Grade 1	C03-A001
H/B/gel 1 (Thickened Mustard)	C03-A001
H/B/gel 2 (Thickened Mustard)	C03-A001
H2dea	C03-D060
H3tea	C03-C045
HAI	C11-A048
Halocarbon 11	C11-A081
Halocarbon 1113	C11-A177
Halon 1001	C11-A110
Halon 11	C11-A081

Haltox	C11-A110
Hamidop	C11-A103
Hanane	C11-A058
Haptasol	C11-A037
Hare-rid	C11-A159
Hazodrin	C11-A125
HB {Sulfur Mustard and Benzene Mixture}	C03-A001
HBD {Sulfur Mustard and Benzene Mixture}	C03-A001
HBDV (Thickened Mustard) {Sulfur Mustard and Monochlorobenzene thickened with Chlorinated Rubber}	C03-A001
HBV (Thickened Mustard) {Sulfur Mustard and Monochlorobenzene thickened with Chlorinated Rubber}	C03-A001
HCC 150	C11-A070
HCCP	C11-A085
HCCPD	C11-A085
HD	C03-A001
HD (Distilled)	C03-A001
HD and HN1 Mixture	C03-A
HD and HN3 Mixture	C03-A
HD and Q Mixture	C03-A004
HD and T Mixture	C03-A005
HD Sulfoxide	C03-D056
HDO	C03-D056
HDO2	C03-D055
H-E1A3-MM	C01-D179
Heksafluoroaceton	C11-A086
Heksahidropiridin	C11-A141
Heksahlorociklopentadien	C11-A085
Heksakloorisyklopentadieeni	C11-A085
Heliosoufre	C01-C061
Hendecadeuteriocyclohexyl Methylphosphonofluoridate	C01-A005
Hepatate	C07-A006
Hepatic Acid	C07-A006
Hepatic Gas	C07-A006
HEPT	C11-A167
Hepthexamite	C11-A167
Herbaxon	C11-A132
Herboxone	C11-A132
Hercules 528	C11-A061
Hercules AC528	C11-A061
Herkal	C11-A055
Herkol	C11-A055
Hex	C11-A085
Hexachloorcyclopentadieen	C11-A085
Hexachlorcyclopentadien	C11-A085
Hexachlorcyklopentadien	C11-A085
Hexachloro-1,3-cyclopentadiene	C11-A085
Hexachlorocyclopentadiene	C11-A085
Hexachloro-cyclopentadiene	C11-A085

(*Continued*)

Hexachlorohexahydromethano-2,4,3-benzodioxathiepin-3-oxide	C11-A063
Hexachloromethyl Carbonate	C10-A005
Hexafluor-2-propanon	C11-A086
Hexafluoraceton	C11-A086
Hexafluoreto de Selênio	C11-A149
Hexafluoreto de Telúrio	C11-A162
Hexafluorid Selenu	C11-A149
Hexafluoridotellurium	C11-A162
Hexafluoro-2-propanone	C11-A086
Hexafluoroacetone	C11-A086
Hexafluoropropan-2-one	C11-A086
Hexafluoropropanone	C11-A086
Hexafluorotellurium	C11-A162
Hexafluorotungsten	C11-A179
Hexafluoro-λ6-selane	C11-A149
Hexafluorpropan-2-on	C11-A086
Hexafluorure de Sélénium	C11-A149
Hexafluorure de Tellure	C11-A162
Hexafluorure de Tungstène	C11-A179
Hexafluoruro de Selenio	C11-A149
Hexafluoruro de Wolframio	C11-A179
Hexahidropiridina	C11-A141
Hexahydroaniline	C11-A048
Hexahydroazine	C11-A141
Hexahydrobenzenamine	C11-A048
Hexahydropyridine	C11-A141
Hexakis(fluoranyl)tungsten	C11-A179
Hexamite	C11-A167
Hexasan	C11-A137
Hexasul	C01-C061
Hexathion	C11-A036
Hexazane	C11-A141
Hexazano	C11-A141
HFA	C11-A078
HFA	C11-A086
Hidreto de Fósforo	C11-A139
Hiđrô Clorua	C11-A088
Hidrogen Bromida	C11-A087
Hidrogen Tetrafluoroborate	C11-A169
Hidrógeno Cianido	C07-A001
Hidrohlorid	C11-A088
Hidrojen Klorür	C11-A088
Hiđrôxiđôtriôxiđôclorin	C11-A135
Hidrură de Stibiu	C11-A153
Hidruro de Fósforo	C11-A139
Higany(II)-cianid	C11-A100
Higany-cianid	C11-A100
Higany-dicianid	C11-A100
Hildan	C11-A063
HL	C03-A010

Hlorotrifluoroetilen	C11-A177
Hlorovodonik	C11-A088
HLV (Thickened HL)	C03-A010
HL-Yellow	C03-A010
HM {Sulfur Mustard and Monochlorobenzene}	C03-A001
HMV (Thickened Mustard) {Sulfur Mustard and Monochlorobenzene}	C03-A001
HN 1	C01-C099
HN1	C03-A016
HN2	C03-A017
HN3	C03-A018
HO	C03-A001
HOE 2671	C11-A063
Hong Nien	C11-A137
Hop Chat 1080	C11-A152
Hostaquik	C11-A137
Hosugen	C10-A003
Hot Stuff	C03-A001
HP {Sulfur Mustard and Bis(2-chloroethyl) Ether Mixture}	C03-A001
HQ	C03-A004
HQ9275000	C11-A052
HS	C03-A001
HSM 1	C03-A002
HSV (Thickened) {Sulfur Mustard and Chlorinated Rubber Mixture}	C03-A001
HT	C03-A005
HTV {Thickened with Chlorinated Rubber}	C03-A005
HTV CR (Thickened) {Sulfur Mustard (60%) and O-Mustard Mixture (40%) Mixture with Chlorinated Rubber}	C03-A005
HTV(CR)(MM) (Thickened) {Sulfur Mustard (60%) and O-Mustard Mixture (40%) Mixture with Chlorinated Rubber and Polymethyl Methacrylate}	C03-A005
HTV(MM) (Thickened) {Sulfur Mustard (60%) and O-Mustard Mixture (40%) Mixture with Polymethyl Methacrylate}	C03-A005
Hun Stoffe	C03-A001
Hunig's Base	C01-D176
Hunig's Reagent	C01-D176
HVV (Thickened Sulfur Mustard)	C03-A001
Hydoselenic Acid, Anhydrous	C11-A091
Hydraargyrum Bichloratum	C11-A096
Hydrargyri Cyanidum	C11-A100
Hydrargyri Dichloridum	C11-A096
Hydrargyrum Bichloratum	C11-A096
Hydrargyrum Cyanatum	C11-A100
Hydrargyrum Oxid Flav	C11-A098
Hydrargyrum Oxydatum Rubrum	C11-A098
Hydrazine, 1,2-Dimethyl-	C11-A059
Hydrazine, Methyl-	C11-A116
Hydrazomethane	C11-A059
Hydrazomethane	C11-A116
Hydrid Fosforu	C11-A139
Hydrideiodine	C11-A090

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Hydrideselenium	C11-A091
Hydridofluorine	C11-A089
Hydriodicacid	C11-A090
Hydriodide	C11-A090
Hydro Bromide	C11-A087
Hydro Bromua	C11-A087
Hydro Chloride	C11-A088
Hydrobromid	C11-A087
Hydrobromide	C11-A087
Hydrochloric Acid Gas	C11-A088
Hydrochloric Acid, Anhydrous	C11-A088
Hydrochloric Gas	C11-A088
Hydrochloride	C11-A088
Hydrochlorie	C11-A088
Hydrochoride	C11-A088
Hydrocloride	C11-A088
Hydrocyanic Acid	C07-A001
Hydrocyanic Acid, Hydrate	C07-A001
Hydrocyanic Acid, Potassium Salt	C07-C008
Hydrocyanic Acid, Sodium Salt	C07-C009
Hydrocyanic Ether	C11-A142
Hydrofluoboric Acid	C11-A169
Hydrofluoride	C11-A089
Hydrogen Antimonide	C11-A153
Hydrogen Arsenide	C08-A001
Hydrogen Boride	C11-A052
Hydrogen Bromide	C11-A087
Hydrogen Bromide, Anhydrous	C11-A087
Hydrogen Chlorid	C11-A088
Hydrogen Chloride	C11-A088
Hydrogen Cloride	C11-A088
Hydrogen Cyanide	C07-A001
Hydrogen Diethyl Phosphite	C01-C087
Hydrogen Dimethyl Phosphite	C01-C085
Hydrogen Fluoride, Anhydrous	C11-A089
Hydrogen Iodide	C11-A090
Hydrogen Iodide, Anhydrous	C11-A090
Hydrogen Monobromide	C11-A087
Hydrogen Monofluoride	C11-A089
Hydrogen Monoiodide	C11-A090
Hydrogen Monosulfide	C07-A006
Hydrogen Nitrate	C11-A126
Hydrogen Phosphide	C11-A139
Hydrogen Phosphine	C11-A139
Hydrogen Potassium Difluoride	C01-C078
Hydrogen Potassium Fluoride	C01-C078
Hydrogen S-[2-(Bis-(1-Methylethyl)amino)ethyl] Methylphosphonothioate	C01-D177
Hydrogen S-[2-(Bis(1-methylethyl)amino)ethyl] Methylphosphonothioate	C01-D177
Hydrogen S-[2-(Bis(1-methylethyl)amino)ethyl] Methylphosphonothiolate	C01-D177
Hydrogen S-[2-(Bis(isopropyl)amino)ethyl] Methylphosphonothioate	C01-D177

Hydrogen S-[2-(Diisopropylamino)ethyl] Methylphosphonothioate	C01-D177
Hydrogen S-[2-(Diisopropylamino)ethyl] Methylphosphonothiolate	C01-D177
Hydrogen S-2-Bis(1-methylethyl)aminoethyl Methylphosphonothioate	C01-D177
Hydrogen S-2-Bis(1-methylethyl)aminoethyl Methylphosphonothiolate	C01-D177
Hydrogen S-2-Dimethylaminoethyl Ethylphosphonothioate	C01-D179
Hydrogen S-2-Dimethylaminoethyl Ethylphosphonothiolate	C01-D179
Hydrogen S-2-Dimethylaminoethyl Methylphosphonothiolate	C01-D178
Hydrogen Selenide	C11-A091
Hydrogen Sulfate	C11-A157
Hydrogen Sulfide	C07-A006
Hydrogen Sulfure	C07-A006
Hydrogen Sulphide	C07-A006
Hydrogen Tetrafluoroborate	C11-A169
Hydrogenbromid	C11-A087
Hydrogenbromide	C11-A087
Hydrogenchlorid	C11-A088
Hydrogène Phosphor	C11-A139
Hydrogène Sélénié	C11-A091
Hydrogene Sulfure	C07-A006
Hydrogene Sulphure	C07-A006
Hydrogenfluorid	C11-A089
Hydrogenii Bromidum	C11-A087
Hydrogenii Chloridum	C11-A088
Hydrogeniodid	C11-A090
Hydrogenium Bromatum	C11-A087
Hydrogenium Chloratum	C11-A088
Hydrogenklorid	C11-A088
Hydrogenselenid	C11-A091
Hydrogen-tetraoxochlorat(−I)	C11-A135
Hydroiodic Acid	C11-A090
Hydronium Fluoride	C11-A089
Hydronium Perchlorate	C11-A135
Hydroselenic Acid	C11-A091
Hydrosulfurate	C07-A006
Hydrosulfuric Acid	C07-A006
Hydrox	C03-C041
Hydroxidotrioxidochlorine	C11-A135
Hydroxy-2-pentanedioic Acid, Dimethyl Ester, Dimethyl Phosphate	C11-A018
Hydroxycarbonimidic Dibromide	C05-A002
Hydroxycarbonimidic Dichloride	C05-A001
Hydroxyglutaconic Acid, Dimethyl Ester, Dimethyl Phosphate	C11-A018
Hydrure D'antimoine	C11-A153
Hydrure de Phosphore	C11-A139
Hydrure de Selenium	C11-A091
Hylemax	C11-A065
Hylemox	C11-A065
Hylene	C11-A173
Hylene-T	C11-A174
Hyperchloric Acid	C11-A135

(*Continued*)

Hyperite	C03-A001
Hypochlorous Thioanhydride	C03-C039
Hyrdogen Bromide	C11-A087
HZ8750000	C01-C097
- I -	
I-4	C11-A033
I14-53743	C11-A060
I-112	C11-A009
I-160	C01-C061
I-163	C10-A002
IA0525000	C03-A036
IA1750000	C03-A017
IBCF	C11-A092
i-Butyl Chloroformate	C11-A092
Idrogeno Fosforato	C11-A139
Idrogeno Solforato	C07-A006
Idrogeno Tetrafluoroborato	C11-A169
Idruro di Antimonio	C11-A153
Idruro di Fosforo (III)	C11-A139
Idruro Fosforoso	C11-A139
Ifblarr Poison	C11-A078
II99F8594N	C01-C075
IM4025000	C01-D174
Imcl-2-propyl	C01-C054
Imidocarbonyl Chloride Fluoride, Hydroxy-, 1-Methylethyl Phosphorochloridate	C01-C129
Imidocarbonyl Chloride Fluoride, Hydroxy-, Ethyl Phosphorobromidate	C01-C122
Imidocarbonyl Chloride Fluoride, Hydroxy-, Ethyl Phosphorochloridate	C01-C123
Imidocarbonyl Chloride Fluoride, Hydroxy-, Ethyl Phosphorofluoridate	C01-A046
Imidocarbonyl Chloride Fluoride, Hydroxy-, Isopropyl Phosphorochloridate	C01-C129
Imidocarbonyl Chloride Fluoride, Hydroxy-, Methyl Phosphorochloridate	C01-C115
Imidocarbonyl Chloride Fluoride, Hydroxy-, Methyl Phosphorofluoridate	C01-A042
Imidocarbonyl Chloride Fluoride, Hydroxy-, O-(2-Chloro-1-methylethyl Phosphorofluoridate)	C01-A050
Imidocarbonyl Chloride Fluoride, Hydroxy-, O-(2-Chloro-1-methylpropyl phosphorofluoridate)	C01-A051
Imidocarbonyl Chloride Fluoride, Hydroxy-, O-(2-Chloro-1-methylpropyl phosphorochloridate)	C01-C143
Imidocarbonyl Chloride Fluoride, Hydroxy-, O-(2-Chloroethyl Phosphorofluoridate)	C01-A049
Imidocarbonyl Chloride Fluoride, Hydroxy-, O-(2-Chloroethyl Phosphorochloridate)	C01-C121
Imidocarbonyl Chloride Fluoride, Hydroxy-, Phosphorodibromidate	C01-C109
Imidocarbonyl Chloride Fluoride, Hydroxy-, Phosphorodichloridate	C01-C111
Imidocarbonyl Chloride, Hydroxy-, 1-Methylethyl Phosphorochloridate	C01-C133
Imidocarbonyl Chloride, Hydroxy-, Ethyl Phosphorofluoridate	C01-A045
Imidocarbonyl Chloride, Hydroxy-, Isopropyl Phosphorochloridate	C01-C133
Imidocarbonyl Chloride, Hydroxy-, Methyl Phosphorochloridate	C01-C117
Imidocarbonyl Chloride, Hydroxy-, Methyl Phosphorofluoridate	C01-A041
Imidocarbonyl Chloride, Hydroxy-, Phosphorodichloridate	C01-C112
Imidocarbonyl Chloride, Phenyl-	C10-A013
Imidocarbonyl Fluoride, Hydroxy-, 1-Methylethyl Phosphorochloridate	C01-C137
Imidocarbonyl Fluoride, Hydroxy-, Ethyl Phosphorochloridate	C01-C126
Imidocarbonyl Fluoride, Hydroxy-, Ethyl Phosphorofluoridate	C01-A047
Imidocarbonyl Fluoride, Hydroxy-, Isopropyl Phosphorochloridate	C01-C137
Imidocarbonyl Fluoride, Hydroxy-, Methyl Phosphorochloridate	C01-C118

Imidocarbonyl Fluoride, Hydroxy-, Methyl Phosphorofluoridate	C01-A043
Imidocarbonyl Fluoride, Hydroxy-, Phosphorodichloridate	C01-C110
Iminodiethanol	C03-D060
IMP	C01-D170
IMPA	C01-D170
Imperial Green	C11-A046
IMPF	C01-A002
IN 1179	C11-A107
Inferno	C01-A014
INOmax	C11-A127
Insectigas D	C11-A055
Insecto	C11-A063
Insectophene	C11-A063
Insyst-D	C11-A062
Invisi-Gard	C11-A143
Iodane	C11-A090
Iodine Cyanide	C07-A004
Iodine Monocyanide	C07-A004
Iodocyanide	C07-A004
Iodure D'hydrogene	C11-A090
Iodure D'hydrogene Anhydre	C11-A090
IP8750000	C01-C098
Iperito	C03-A001
Iperyt	C03-A001
IPMC	C11-A143
Ipoazotide	C11-A128
Iprit	C03-A001
i-Propyl Chloroformate	C11-A093
i-Propyl Isocyanate	C11-A094
IPTBO	C06-A003
Iradicav	C01-C077
Iron Carbonyl	C09-A002
Iron Pentacarbonyl	C09-A002
IS 60	C01-C061
IS 7020	C01-C061
IS 90	C01-C061
Isceon 131	C11-A081
Iscobrome	C11-A110
Iscobrome D	C11-A069
IS-HS 6033	C01-C061
IS-HS 7020	C01-C061
Isobicyphat	C06-A003
Isobutanimidamide, N,N-Diethyl- {Novichok Precursor}	C01-C
Isobutanimidamide, N,N-Dimethyl- {Novichok Precursor}	C01-C
Isobutanimidamide, N,N-Dipropyl- {Novichok Precursor}	C01-C
Isobutene, Octafluoro-	C10-A008
Isobutenyl Chloride	C11-A102
Isobutlychloroformate	C11-A092
Isobutoxycarbonyl Chloride	C11-A092

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Isobutyichioroformate	C11-A092
Isobutyl Carbonochloridate	C11-A092
Isobutyl Chioroformate	C11-A092
Isobutyl Chloridocarbonate	C11-A092
Isobutyl Chlorocarbonate	C11-A092
Isobutyl Chloroformate	C11-A092
Isobutyl Choroformate	C11-A092
Isobutyl S-2-Diethylaminoethyl Methylphosphonothiolate	C01-A016
Isobutylchlorocarbonate	C11-A092
Isobutyloxycarbonyl Chloride	C11-A092
Isobutyronitrile	C11-A095
Isocarb	C11-A143
Isocianato de Metila	C11-A117
Isocianato de Metilo	C11-A117
Isocianato di Metile	C11-A117
Isocianato di o-(p-Isocianatobenzil)fenile	C11-A113
Isocyanate de Methyle	C11-A117
Isocyanate, Methyl-	C11-A117
Isocyanatmetan	C11-A117
Isocyanatobutane	C11-A028
Isocyanatomethaan	C11-A117
Isocyanatomethane	C11-A117
Isocyanic Acid Butyl Ester	C11-A028
Isocyanic Acid Isopropyl Ester	C11-A094
Isocyanic Acid n-Butyl Ester	C11-A028
Isocyanic Acid normal-Butyl Ester	C11-A028
Isocyanic Acid, 2-Methyl-meta-phenylene Ester	C11-A174
Isocyanic Acid, 2-Methyl-m-phenylene Ester	C11-A174
Isocyanic Acid, 4-Methyl-meta-phenylene Ester	C11-A173
Isocyanic Acid, 4-Methyl-m-phenylene Ester	C11-A173
Isocyanic Acid, Diphenylmethylene Ester	C11-A113
Isocyanic Acid, Methyl Ester	C11-A117
Isocyanic Acid, Methylenediphenylene Ester	C11-A113
Isocyanic Acid, t-Butyl Ester	C11-A029
Isocyanic Acid, tert-Butyl Ester	C11-A029
Isocyansäuremethylester	C11-A117
Isopropene Cyanide	C11-A101
Isopropenylcarbonitrile	C11-A101
Isopropenylcyanid	C11-A101
Isopropenylnitrile	C11-A101
Isopropilamina	C01-C100
Isopropoxymethylphoshoryl Fluoride	C01-A002
Isopropoxymethylphosphonyl Fluoride	C01-A002
Isopropoxymethylphosphoryl Fluoride	C01-A002
Isopropyl Alcohol and Isopropyl Amine Mixture	C01-C063
Isopropyl Amine	C01-C100
Isopropyl Aminoethylmethyl Phosphonite	C01-C064
Isopropyl Bicyclic Phosphate	C06-A003
Isopropyl Bicyclophosphate	C06-A003
Isopropyl Carbonochloridate	C11-A093

Isopropyl Chlorocarbonate	C11-A093
Isopropyl Chloroformate	C11-A093
Isopropyl Chloromethanate	C11-A093
Isopropyl Chloromethanoate	C11-A093
Isopropyl Chloromethylphosphinate	C01-C054
Isopropyl Cyanide	C11-A095
Isopropyl Dimethylamidocyanidophosphate	C01-A009
Isopropyl Ester of Methylphosphonofluoridic Acid	C01-A002
Isopropyl Ethylfluorophosphinate	C01-A004
Isopropyl Ethylphosphonofluoridate	C01-A004
Isopropyl Ethylphosphonofluoridoate	C01-A004
Isopropyl Hydrogen Methylphosphonate	C01-D170
Isopropyl Isocyanate	C11-A094
Isopropyl Methanefluorophosphonate	C01-A002
Isopropyl Methyl Phosphonic Acid	C01-D170
Isopropyl Methylfluorophosphate	C01-A002
Isopropyl Methylfluorophosphonate	C01-A002
Isopropyl Methylphosphonate	C01-D170
Isopropyl Methylphosphonic Acid	C01-D170
Isopropyl Methylphosphonochloridate	C01-C054
Isopropyl Methylphosphonofluoridate	C01-A002
Isopropyl Methylphosphonofluoridoate	C01-A002
Isopropyl N,N-Dimethylphosphoramidocyanidate	C01-A009
Isopropyl Nitrile	C11-A095
Isopropyl Phosphite	C01-C164
Isopropyl Phosphite, Tri-	C01-C164
Isopropyl S-2-Diethylaminoethyl Methylphosphonothiolate	C01-A028
Isopropylamino-O-ethyl-(4-methylmercapto-3-methylphenyl)phosphate	C11-A074
Isopropyl-bis-(2-chloro-ethyl)-amine	C03-A029
Isopropyl-bis(beta-chloroethyl) Amine	C03-A029
Isopropylchloorcarbonaat	C11-A093
Isopropylchloorformiaat	C11-A093
Isopropylchloormethanoaat	C11-A093
Isopropylchloramine	C01-D172
Isopropylchlorformiat	C11-A093
Isopropyl-chloro-formate	C11-A093
iso-Propylchloroformate	C11-A093
Isopropylester Kyseliny Chlormravenci	C11-A093
Isopropylester Kyseliny Methylfluorfosfonove	C01-A002
Isopropylidenedioxy)phenyl N-Methylcarbamate	C11-A014
Isopropylisocynate	C11-A094
Isopropylkyanid	C11-A095
Isopropyl-methylphosphoryl Fluoride	C01-A002
Isopropylmethylpyrimidyl Diethyl Thiophosphate	C11-A051
Isopropylphosphonic Acid Dichloride	C01-C096
Isopropylphosphonic Dichloride	C01-C096
Isopropylphosphonic Difluoride	C01-C068
Isopropylphosphonothioic Dichloride	C01-C070
Isopropylphosphonyl Dichloride	C01-C096

(*Continued*)

Isopropylphosphonyl Difluoride	C01-C068
Isopropylphosphoramidic Acid, 4-(Methylthio)-meta-tolyl Ethyl Ester	C11-A074
Isopropylphosphoramidic Acid, 4-(Methylthio)-m-tolyl Ethyl Ester	C11-A074
Isopropyl-S	C03-A029
Isoquinolinium, 2,2'-(1,8-Octanediyl)bis[5-[[(dimethylamino)carbonyl]oxy]-, Dibromide	C02-A015
Isoquinolinium, 5-[[(Dimethylamino)carbonyl]oxy]-2-[10-(trimethylammonio)decyl]-, Bis [Tetraphenylborate(1-)]	C02-A029
Isoquinolinium, 5-[[(Dimethylamino)carbonyl]oxy]-2-[10-(trimethylammonio)decyl]-, Dibromide	C02-A029
Isothiocyanate D'allyle	C11-A007
Isothiocyanato-1-propene	C11-A007
Isothiocyanic Acid, Allyl Ester	C11-A007
Isothiocyansaeureallylester	C11-A007
Isotox	C11-A133
Isotron 11	C11-A081
Itopaz	C11-A065
Ivalon	C11-A083
Izocyjanian Metylu	C11-A117
Izocyjanometan	C11-A117
Izopropena Cianido	C11-A101
- J -	
JBR {Hydrogen Cyanide (50%), Arsenic Trichloride (25%) and Chloroform (25%) Mixture}	C07-A
Jihosugen	C10-A004
JL {Hydrogen Cyanide (50%) and Chloroform (50%) Mixture}	C07-A001
JO5069000	C03-D059
Jodcyan	C07-A004
- K -	
K	C03-A018
K2-Stoff	C10-A004
Kadett	C11-A125
Kadmium	C11-A030
Kadmu Tlenek	C11-A030
Kalium Cyanid	C07-C008
Kaliumcyanid	C07-C008
Kaliumzyanid	C07-C008
Kaltron 11	C11-A081
Kampstoff "Lost"	C03-A001
Kappa-bifenthrine	C11-A016
Karbicron	C11-A056
Karbofenothion	C11-A036
Karbofuranu	C11-A032
Karbonoklorido de Propilo	C11-A144
Karidium	C01-C077
Karigel	C01-C077
Karsan	C11-A083
Kasutop Dust	C11-A064
Kavadel	C11-A061
Kayafume	C11-A110
Kayazinon	C11-A051
Kayazol	C11-A051
KB-49235	C01-C072

KEN	C11-A178
Kendallite {Hydrogen Cyanide and Hydrogen Chloride Mixture}	C07-A
Kenofuran	C11-A032
Ketene Dimer	C11-A057
Ketokil No. 52	C11-A013
Ketone, t-Butyl Methyl	C01-C101
Ketone, tert-Butyl Methyl	C01-C101
KH2100000	C11-A068
KH9275000	C11-A069
Khladon 11	C11-A081
Khloreks	C11-A017
KI0525000	C11-A070
KI8575000	C11-A165
Kill-All	C11-A151
Killax	C11-A167
Killex	C11-A167
Kilmite 40	C11-A167
King of Battle Gases	C03-A001
King's Green	C11-A046
Kipsin	C11-A107
Kiselfluorid	C11-A150
Kiseline	C11-A088
Kiselklorid	C11-A166
Kiseltetrafluorid	C11-A150
Kiseltetraklorid	C11-A166
KK0875000	C03-C041
KK5075000	C01-C103
KK5950000	C01-C104
KL2975000	C03-D060
KL9275000	C03-C045
Kleen-Dok	C11-A051
Klooritrifluorieteeni	C11-A177
Klopp	C10-A006
Kloramin	C03-A017
Kloroformiato de Propilo	C11-A144
Klorpikrin	C10-A006
Klortsian	C07-A003
KM2975000	C03-C037
KM2975000	C03-C038
KM7175000	C03-D049
KN0875000	C11-A017
KN1575000	C10-A011
KN3339000	C03-D057
KN6650000	C11-A044
Knox Out	C11-A051
K-Obiol	C11-A049
Kocide	C01-C061
Kohlendisulfid	C11-A033
Kohlenmonoxid	C09-A001

(*Continued*)

Kohlenoxyd	C09-A001
Kokotine	C11-A133
Kolloidschwefel 95	C01-C061
Kolo 100	C01-C061
Kolofog	C01-C061
Kolospray	C01-C061
Kolphos	C11-A133
Koolmonoxyde	C09-A001
Koolstofdisulfide	C11-A033
Koolstofoxychloride	C10-A003
Kopfume	C11-A069
Kop-thiodan	C11-A063
Koreberon	C01-C077
K-Othrine	C11-A049
KQ9020000	C01-C099
Krecalvin	C11-A055
Kromfax Solvent	C03-C037
Krotonaldehyd	C11-A047
KS-00000142	C01-C058
KSC352S4T	C01-C058
KSC498A6N	C01-C059
K-Stoff	C10-A013
K-Stoff	C11-A111
KU9625000	C11-A180
Kumulus	C01-C061
Kurorupikurin	C10-A006
Kurunai	C11-A138
Kvävedioxi	C11-A128
Kvävefluorid	C11-A129
Kvävemonoxid	C11-A127
Kväveoxid	C11-A127
Kvävetrifluorid	C11-A129
Kvicksilver(II)oxid	C11-A098
Kvicksilvercyanid	C11-A100
Kwas Chlorowy(VII)	C11-A135
Kwas Fluorooctowy	C11-A078
Kwas Nadchlorowy	C11-A135
Kwas Tetrafluoroborowy	C11-A169
Kwell	C11-A133
Kwik(II)chloride	C11-A096
Kwik(II)nitraat	C11-A097
Kwik(II)oxide	C11-A098
Kwikdichloride	C11-A096
Kwikdinitraat	C11-A097
Kwik-kil	C11-A159
Kwikmonoxide	C11-A098
Kwiknitraat	C11-A097
Kwiksan	C11-A137
Kwit	C11-A065
KX2450000	C11-A071

KX3500000	C03-D047
KX3850000	C11-A136
KX5075000	C11-A072
Kyanid Sodny	C07-C009
Kypthion	C11-A133
Kyselina Chloristá	C11-A135
Kyselina Dusicne	C11-A126
Kyselina O,O-Diethyldithiofosforecna	C01-C073
- L -	
L	C04-A002
L {Sulfur Mustard and Chlorobenzene Mixture}	C03-A001
L III	C04-C007
L IV {Lewisite 1, Lewisite 2, Lewisite 3 and Arsenic Trichloride Mixtures}	C04-C
L1	C04-A002
L1	C10-A003
L-3	C04-C007
L3	C10-A003
L-4 {Lewisite 1, Lewisite 2, Lewisite 3 and Arsenic Trichloride Mixtures}	C04-C
Lactonitrile, 2-Methyl-	C11-A001
Lan Bait	C11-A107
Lancastrite {Phosgene, Chlorine and Arsenic Trichloride Mixture}	C10-A
Landisan	C11-A108
Lannabait	C11-A107
Lannate	C11-A107
Lanox	C11-A107
Lansul	C01-C061
Latka 1080	C11-A152
Lauxtol	C11-A134
Le 100	C01-A001
Lead Tetraethide	C11-A168
Lead Tetraethyl	C11-A168
Lead Tetramethyl	C11-A170
Ledon 11	C11-A081
Lekamin	C03-A018
Lemoflur	C01-C077
Lethalaire G-52	C11-A167
Lethalaire G-57	C11-A161
Lethalaire G-59	C11-A148
Lethox	C11-A036
Levinstein Mustard	C03-A001
Levinsteinlost	C03-A001
Lewisita	C04-A002
Lewisite	C04-A002
Lewisite - Sulfur Mustard	C03-A010
Lewisite 1	C04-A002
Lewisite 3	C04-C007
Lewisite 3, (E,E,E)-	C04-C007
Lewisite III	C04-C007
Lewisite Oxide	C04-D008

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Leytosan	C11-A137
L-Fume {Aluminum Phosphide}	C11-A139
Lindan	C11-A055
Lindanmafu	C11-A055
Liquamat	C01-C061
Liquid Death	C09-A003
Líquido de Muthmann	C11-A164
Liquiphene	C11-A137
Lirohex	C11-A167
Liroprem	C11-A134
Lirothion	C11-A133
Lizetan	C11-A106
LM6475000	C11-A076
Lood-tetraethyl	C11-A168
Lorophyn	C11-A137
Loruro Mercúrico;	C11-A096
Lost	C03-A001
L-Oxide	C04-D008
LQ5775000	C11-A006
LQ5890000	C11-A026
LQ6125000	C11-A066
LQ6475000	C11-A093
LQ6830000	C11-A144
LQ7350000	C10-A004
LQ8925000	C11-A115
LS 10	C11-A166
LS-106963	C01-C055
LS-18407	C02-A050
Luizyt	C04-A002
Luizyte	C04-A002
Lung Gas No. 1	C10-A003
Lưu Huỳnh Điôxít	C11-A154
Lưu Huỳnh Tetraflorua	C11-A155
Lưu Huỳnh Trioxit	C11-A156
Lưu Huỳnh(IV) Oxit	C11-A154
LXA802UF5G	C01-C069
Lyuisit	C04-A002
Lyvizit	C04-A002
LZ9450000	C11-A018

- M -

(Methoxy-methylphosphoryl)oxymethane	C01-C059
(Methyl)phosphonate	C01-C060
(Methyl)sulfane	C11-A118
(Methyldithio) Methane	C01-C062
(Methylimino)(oxo)methane	C11-A117
(Methylmercurio)guanidinocarbonitrile	C11-A119
(Methylthio)-3,5-xylyl Methylcarbamate	C11-A106
(Mono)bromomethane	C11-A110
(Monochloromethyl) Ether	C10-A011
M 74	C11-A062

M-01	C01-A016
M-02	C01-A002
M-03	C01-A003
M-1	C04-A002
M-3	C04-C007
M-4 {Lewisite 1, Lewisite 2, Lewisite 3 and Arsenic Trichloride Mixtures}	C04-C
M44 Capsules	C07-C009
M97C0A6S8U	C01-C081
MA	C04-A004
Macabre	C11-A125
Mafu	C11-A055
Magnesium Aluminum Phosphide	C11-A139
Magnesium Arsenide	C08-C
Magnesium Phosphide	C11-A139
Magnetic 6	C01-C061
Magnetic 70	C01-C061
Magtoxin {Magnesium Phosphide}	C11-A139
Malix	C11-A063
Malux	C11-A063
Manganite {Hydrogen Cyanide (50%) and Arsenic Trichloride (50%) Mixture}	C07-A001
Manguinite	C07-A003
MAPJ	C11-A064
Mark 1 C	C03-A001
Marsite	C04-C006
Marvex	C11-A055
Masutado	C03-A001
Masutado/Ruisato	C03-A010
Mathane, Oxybischloro	C10-A011
Matting Acid	C11-A157
Mattling Acid	C11-A157
Mauginite	C07-A003
Mauguinite	C07-A003
Maux	C11-A063
MB	C11-A110
MB 333	C11-A134
MBA	C03-A017
MBA Hydrochloride	C03-A017
MBC Soil Fumigant	C11-A110
MBC-33	C11-A110
M-B-R 98	C11-A110
MBX	C11-A110
MCE	C01-A001
MCF	C11-A111
m-Cresol, 4-(Methylthio)-, Ethyl Isopropylphosphoramidate	C11-A074
MCULE-8262188101	C01-C058
MD	C04-A003
MD3	C11-A045
MD4	C10-A006
MD6	C03-A009

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MD7	C03-A001
MD8	C10-A003
MDEA	C03-C043
MDEA (Diol)	C03-C043
MDI	C11-A113
MDR	C11-A113
Me F248	C11-A032
MEA	C11-A068
Meadow Green	C11-A046
MeAN	C11-A101
Mebicyphat	C06-A001
Mechlorethamine	C03-A017
Mechlorethamine Hydrochloride	C03-A017
Mecloretamina	C03-A017
Medathion	C11-A105
Medemo	C01-A018
Medikus	C04-A003
MeEHg	C11-A108
Megatox	C11-A077
Megatron	C11-A125
Meidon 15 Dust	C11-A064
Mema	C11-A108
MEMA	C11-A119
Memilene	C11-A107
Meniphos	C11-A123
Menite	C11-A123
Mentox 600CE	C11-A120
Meodinon	C11-A051
Meptox	C11-A120
Meracen	C11-A137
Mercaptan Methylique	C11-A118
Mercaptan Methylique Perchlore	C10-A014
Mercaptodimethur	C11-A106
Mercaptofos	C11-A050
Mercaptometan	C11-A118
Mercaptometano	C11-A118
Mercaptomethaan	C11-A118
Mercaptomethan	C11-A118
Mercaptomethane	C11-A118
Mercaptophos	C11-A050
Mercron	C11-A137
Mercuran	C11-A108
Mercurialin	C11-A109
Mercuric Bichloride	C11-A096
Mercuric Chloride	C11-A096
Mercuric Cyanide	C11-A100
Mercuric Ethyl Chloride	C11-A073
Mercuric Nitrate	C11-A097
Mercuric Oxide	C11-A098
Mercuric Oxide, Red	C11-A098

Mercuric Oxide, Yellow	C11-A098
Mercuriphenyl Acetate	C11-A137
Mercurius Cyanatus	C11-A100
Mercuron	C11-A137
Mercurous Nitrate	C11-A099
Mercury (1+) Nitrate	C11-A099
Mercury (2+) Nitrate	C11-A097
Mercury (2+) Oxide	C11-A098
Mercury (I) Nitrate	C11-A099
Mercury (II) Chloride	C11-A096
Mercury (II) Cyanide	C11-A100
Mercury (II) Ethyl Chloride	C11-A073
Mercury (II) Nitrate	C11-A097
Mercury (II) Oxide	C11-A098
Mercury Bichloride	C11-A096
Mercury Chloride	C11-A096
Mercury Chloride (2)	C11-A096
Mercury Chloromercurate(II)	C11-A096
Mercury Cyanide	C11-A100
Mercury Dichloride	C11-A096
Mercury Dicyanide	C11-A100
Mercury Dinitrate	C11-A097
Mercury Monoxide	C11-A098
Mercury Nitrate	C11-A097
Mercury Oxide	C11-A098
Mercury Perchloride	C11-A096
Mercury Pernitrate	C11-A097
Mercury Phenyl Acetate	C11-A137
Mercury Protonitrate	C11-A099
Mercury(II) Acetate, Phenyl-	C11-A137
Mercury(II) Chloride	C11-A096
Mercury, (3-Cyanoguanidinato-N')methyl-	C11-A119
Mercury, (3-Cyanoguanidino)methyl-	C11-A119
Mercury, (Acetato)(2-methoxyethyl)-	C11-A108
Mercury, (Acetato-kappaO)(2-methoxyethyl)-	C11-A108
Mercury, (Acetato-O)(2-methoxyethyl)-	C11-A108
Mercury, (Acetato-κO)(2-methoxyethyl)-	C11-A108
Mercury, (Acetato-κO)phenyl-	C11-A137
Mercury, (Cyanoguanidinato)methyl-	C11-A119
Mercury, (Cyanoguanidinato-kappaN')methyl-	C11-A119
Mercury, (Cyanoguanidinato-κN')methyl-	C11-A119
Mercury, (Cyanoguanidine)methyl-	C11-A119
Mercury, 2-Methoxyethyl-, Acetate	C11-A108
Mercury, Acetoxy(2-methoxyethyl)-	C11-A108
Mercury, Acetoxyphenyl-	C11-A137
Mercury, Chloroethyl-	C11-A073
Mercury, Dimethyl	C11-A060
Merkaptan Metylowy	C11-A118
Merkuran	C11-A108

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Merkuri-cianid	C11-A100
Merkurioxid	C11-A098
Merpol	C11-A071
Mersolite	C11-A137
Merth-O-gas	C11-A110
Mesomile	C11-A107
Mesurol	C11-A106
Mesyl Chloride	C11-A104
Mesylchoride	C11-A104
Mesylic Acid Chloride	C11-A104
Mesyylikloridi	C11-A104
Metaanisulfonyylikloridi	C11-A104
Metaarsenin Sodu	C11-A151
Métaarsénite de Sodium	C11-A151
Metabrom	C11-A110
Metacide	C11-A120
meta-Cresol, 4-(Methylthio)-, Ethyl Isopropylphosphoramidate	C11-A074
Metafos	C11-A120
Metafume	C11-A110
Metakrilonitril	C11-A101
Metakrilonitrilo	C11-A101
Metakryylinitriili	C11-A101
Metamidafos	C11-A103
Metamidofos	C11-A103
Metamidofos Estrella	C11-A103
Metamidophos	C11-A103
Mêtanal	C11-A083
Metanaldehído	C11-A083
Metanale	C11-A083
Metanatiol	C11-A118
Metanoato de Metila	C11-A115
Metanoato di Metile	C11-A115
Metanotiol	C11-A118
Metansulfonil Hlorid	C11-A104
Metantiol	C11-A118
Metantiolo	C11-A118
Metantiolul	C11-A118
Metaphos	C11-A120
Metaran	C01-C059
meta-Toluene Diisocyanate	C11-A173
meta-Tolylene Diisocyanate	C11-A173
meta-Tolylene Diisocyanate	C11-A174
Metazintox	C11-A013
Methaansulfonylchloride	C11-A104
Methaanthiol	C11-A118
Methacrylnitrile	C11-A101
Methacrylonitrile	C11-A101
Methaldehyde	C11-A083
Methallyl Chloride	C11-A102
Methamidofos	C11-A103

Methamidophos	C11-A103
Methanal	C11-A083
Methanamine	C11-A109
Methanamine, N,N-Dimethyl-	C11-A178
Methanamine, N-Methyl-	C01-C098
Methane Phosphonic Acid Dimethyl Ester	C01-C059
Methane Sulfonic Acid Chloride	C11-A104
Methane Sulfonyl Chloride	C11-A104
Methane Sulphonic Acid Chloride	C11-A104
Methane Sulphonyl Choride	C11-A104
Methane Thiol	C11-A118
Methane Trichloride	C11-A043
Methane, (Methylimino)oxo-	C11-A117
Methane, 1,1'-Oxybis(1-chloro-	C10-A011
Methane, Bis(4-isocyanatocyclohexyl)-	C11-A113
Methane, Bromo-	C11-A110
Methane, Chloromethoxy-	C11-A044
Methane, Dichlorofluoronitroso-	C01-C155
Methane, Fluorotrichloro-	C11-A081
Methane, Isocyanato-	C11-A117
Methane, Nitrotribromo-	C10-A007
Methane, Oxybis[bromo-	C10-A012
Methane, Thiocyanato-	C11-A122
Methane, Tribromonitro-	C10-A007
Methane, Trichlorofluoro-	C11-A081
Methane, Trichloronitro-	C10-A006
Methaneamine	C11-A109
Methanedithione	C11-A033
Methanephosphonic Acid	C01-C060
Methanephosphonic Acid Dichloride	C01-C052
Methanephosphonic Dichloride	C01-C052
Methanephosphonodichloridic Acid	C01-C052
Methanephosphonyl Chloride	C01-C052
Methanephosphonyl Dichloride	C01-C052
Methanesuiphonyl Chloride	C11-A104
Methanesulfenic Acid, Trichloro-, Chloride	C10-A014
Methanesulfenyl Chloride, Trichloro-	C10-A014
Methanesulfonic Acid Chloride	C11-A104
Methanesulfonly Chloride	C11-A104
Methanesulfonoic Acid Chloride	C11-A104
Methanesulfonoyl Chloride	C11-A104
Methanesulfonyl Chloride	C11-A104
Methanesulfonyl Chlorine	C11-A104
Methanesulfonyl Choride	C11-A104
Methanesulfonyl Cloride	C11-A104
Methanesulphenyl Chloride, Trichloro-	C10-A014
Methanesulphonic Acid Chloride	C11-A104
Methanesulphonic Chloride	C11-A104
Methanesulphonyl Chloride	C11-A104

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Methanesulphuryl Chloride	C11-A104
Methanethiol, (Ethylthio)-, S-Ester with O,O-Diethyl Phosphorodithioate	C11-A138
Methanethiol, (Ethylthio)-, S-Ester with O,O-Diethyl Phosphorodithioic Acid	C11-A138
Methanethiol, (t-Butylthio)-, S-Ester with O,O-Diethyl Phosphorodithioate	C11-A163
Methanethiol, (tert-Butylthio)-, S-Ester with O,O-Diethyl Phosphorodithioate	C11-A163
Methanethiole	C11-A118
Methanimidamide, N,N-Dimethyl- {Novichok Precursor}	C01-C
méthanoate de Méthyle	C11-A115
Methanoic Acid Methyl Ester	C11-A115
Methanol, Trichloro-, Carbonate	C10-A005
Methanol, Trichloro-, Chloroformate	C10-A004
Methansäuremethylester	C11-A115
Methansulfonsäurechlorid	C11-A104
Methansulfonyl Chloride	C11-A104
Methansulphonyl Chloride	C11-A104
Methanthioalkohol	C11-A118
Methanthiol	C11-A118
Methaphenamiphos	C11-A074
Methenyl Chloride	C11-A043
Methenyl Trichloride	C11-A043
Methidathion	C11-A105
Methidation	C11-A105
Methiocarbe	C11-A106
Methiokarb	C11-A106
Methiol	C11-A118
Methl Hydrazine	C11-A116
Methlamine	C11-A109
Methlyamine	C11-A109
Methlyfluorophosphonic Acid Isopropyl Ester	C01-A002
Methochloride of N-Methylurethane of 3-Dimethylaminophenol	C02-A051
Meth-O-gas	C11-A110
Methomex	C11-A107
Methoxy Methylchloride	C11-A044
Methoxyathyl-quecksilber-acetat	C11-A108
Methoxycarbonyl Chloride	C11-A111
Methoxychloromethane	C11-A044
Methoxyethelmercuric Acetate	C11-A108
Methoxyethelmercuric Acetic Acid	C11-A108
Methoxyethyl Mercury	C11-A108
Methoxyethylmercuric Acetate	C11-A108
Methoxyethylmercury Acetate	C11-A108
Methoxymethyl Chloride	C11-A044
Methoxyphosphonoyl Dichloride	C01-C161
Methoxyphosphorylchloride	C01-C161
Methvtiolo	C11-A118
Methy Chloroformate	C11-A111
Methyamine	C11-A109
Methybrom	C11-A110
Methyl	C04-A002
Methyl (1Z)-2-(Dimethylamino)-N-(methylcarbamoyloxy)-2-oxoethanimidothioate	C11-A147

Methyl (E)-3-Dimethoxyphosphoryloxybut-2-enoate	C11-A123
Methyl (Z)-3-Dimethoxyphosphoryloxybut-2-enoate	C11-A123
Methyl 1-(Dimethylcarbamoyl)-N-(methylcarbamoyloxy)thioformimidate	C11-A147
Methyl 1605	C11-A120
Methyl 2-(Dimethylamino)-N-([(methylamino)carbonyl]oxy)-2-oxoethanimidothioate	C11-A147
Methyl 2-(Dimethylamino)-N-[(methylcarbamoyl)oxy]-2-oxoethanimidothioate	C11-A147
Methyl 2-(Dimethylamino)-N-[[(methylamino)carbonyl]oxy]-2-oxoethanimidothioate	C11-A147
Methyl 2-Fluoroacetate	C11-A114
Methyl 2-fluoroethanoate	C11-A114
Methyl 2-Isothiocyanato Propionate	C03-D049
Methyl 3-(Dimethoxyphosphinyloxy)crotonate	C11-A123
Methyl 3-[(Dimethoxyphosphoryl)oxy]-2-butenoate	C11-A123
Methyl Acrylonitrile	C11-A101
Methyl Aldehyde	C11-A083
Methyl Allyl Chloride	C11-A102
Methyl Bicyclic Phosphate	C06-A001
Methyl Bladan	C11-A120
Methyl Bromide	C11-A110
Methyl Carbamic Acid 2,3-Dihydro2,2-Dimethyl-7-benzofuranyl Ester	C11-A032
Methyl Carbamic Acid 4-(Methylthio)-3,5-xylyl Ester	C11-A106
Methyl Carbonchloridate	C11-A111
Methyl Carbonimide	C11-A117
Methyl Carbonochloridate	C11-A111
Methyl Carbylamine	C11-A117
Methyl Chioroformate	C11-A111
Methyl Chloridocarbonate	C11-A111
Methyl Chlorocarbonate	C11-A111
Methyl Chlorofluorophosphate {Novichok Precursor}	C01-C
Methyl Chloroformate	C11-A111
Methyl Chloromethyl Ether	C11-A044
Methyl Chlorosilane	C11-A112
Methyl Chlorosulfate	C10-A009
Methyl Chlorosulfonate	C10-A009
Methyl Chlorosulphate	C10-A009
Methyl Chlorosulphonate	C10-A009
Methyl Chlorsulfonate	C10-A009
Methyl Chlorsulphonate	C10-A009
Methyl Choromethyl Ether	C11-A044
Methyl Cyclohexylfluorophosphonate	C01-A005
Methyl Dichloridophosphate	C01-C161
Methyl Dichloroarsine	C04-A003
Methyl Dichlorophosphate	C01-C161
Methyl Dick	C04-A003
Methyl Difluorophosphate {Novichok Precursor}	C01-C
Methyl Difluorophosphite	C01-C053
Methyl Disulfide	C01-C062
Methyl Disulfide	C11-A033
Methyl Ester of Formic Acid	C11-A115
Methyl Ester of Isocyanic Acid	C11-A117

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Methyl Ethyl Isocyanate	C11-A094
Methyl Ethylphosphonofluoridate	C01-A012
Methyl Ethylphosphonofluoridoate	C01-A012
Methyl Fluoroacetate	C11-A114
Methyl Formate	C11-A115
Methyl Fume	C11-A110
Methyl Gusathion	C11-A013
Methyl Guthion	C11-A013
Methyl Hydrazine	C11-A116
Methyl Isocyanate	C11-A117
Methyl Isocynate	C11-A117
Methyl Mercaptan	C11-A118
Methyl Mercuric Dicyandiamide	C11-A119
Methyl Mercury Dicyandiamide	C11-A119
Methyl Methanoate	C11-A115
Methyl N-(Methylcarbamoyloxy)ethanimidothioate	C11-A107
Methyl N-[(Methylcarbamoyl)oxy]thioacetimidate	C11-A107
Methyl N-[1-(Diethylamino)ethylidene]phosphoramidofluoridate	C01-A037
Methyl N',N'-Dimethyl-N-((methylcarbamoyl)oxy)-1-thiooxamimidate	C11-A147
Methyl O-(Methylcarbamoyl)thiolacethohydroxamate	C11-A107
Methyl O-(Methylcarbamoyl)thiolacetohydroxamate	C11-A107
Methyl O-(Methylcarbamyl)thiolacetohydroxamate	C11-A107
Methyl Phenylene Diisocyanate	C11-A173
Methyl Phosphinyl Difluoride	C01-C
Methyl Phosphite	C01-C086
Methyl Phosphonate	C01-C085
Methyl Phosphonic Acid	C01-C060
Methyl Phosphonic Acid, Dimethyl Ester	C01-C059
Methyl Phosphonic Dichloride	C01-C052
Methyl Phosphonothioic Dichloride	C01-C066
Methyl Phosphonous Acid, 2-(Bis(l-methylethyl) Amino) Ethyl Ethyl Ester	C01-C064
Methyl Phosphonous Dichloride	C01-C065
Methyl Phosphonyl Dichloride	C01-C052
Methyl Phosphoramidothioate	C11-A103
Methyl Phosphoric Dichloride	C01-C161
Methyl Phosphorochloridofluoridate {Novichok Precursor}	C01-C
Methyl Phosphorodichloridate	C01-C161
Methyl Phosphorodifluoridate {Novichok Precursor}	C01-C
Methyl Pinacolyl Phosphonofluoridate	C01-A003
Methyl Pinacolyloxy Phosphorylfluoride	C01-A003
Methyl Pinacolyloxyfluorophosphine Oxide	C01-A003
Methyl Pinacolylphosphonofluoridate	C01-A003
Methyl Rhodanate	C11-A122
Methyl Rhodanide	C11-A122
Methyl Sulfate	C03-A009
Methyl Sulfhydrate	C11-A118
Methyl Sulfochloride	C11-A104
Methyl Sulfocyanate	C11-A122
Methyl Sulfonyl Chloride	C11-A104
Methyl Sulphochloride	C11-A104

Methyl Sulphonyl Chloride	C11-A104
Methyl t-Butyl Ketone	C01-C101
Methyl tert-Butyl Ketone	C01-C101
Methyl Thioalcohol	C11-A118
Methyl Thiocyanate	C11-A122
Methyl Thiocyanide	C11-A122
Methyl Thiol	C11-A118
Methyl Trichloride	C11-A043
Methyl Viologen Dichloride	C11-A132
Methyl-(1-(diethylamino)ethylidene)phosphonamidofluoridate	C01-A036
Methyl-(1-(diethylamino)ethylidene)phosphoramidofluoridate	C01-A037
Methyl(2-chloroethyl)(2-chloropropyl)amine	C03-A025
Methyl-(bis(diethylamino)methylene)phosphonamidofluoridate	C01-A039
Methyl(propan-2-yloxy)phosphinic Acid	C01-D170
Methyl-2-(Methylthio)Propionaldehyde O-(Methylcarbamoyl)oxime	C11-A003
Methylaldehyd	C11-A083
Methylamine Anhydrous	C11-A109
Methylaminen	C11-A109
Methylammonia	C11-A109
Methylarsine Dichloride	C04-A003
Methylarsonous Dichloride	C04-A003
Methylazinphos	C11-A013
Methylaziridine	C11-A145
Methyl-beta,beta-dichlorodiethylamine	C03-A017
Methylbis(2-chloroethyl)amine	C03-A017
Methylbis(2-chloroethyl)amine Hydrochloride	C03-A017
Methylbis(2-hydroxyethyl)amine	C03-C043
Methylbis(beta-chloroethyl)amine	C03-A017
Methylbis(beta-chloroethyl)amine Hydrochloride	C03-A017
Methylbis(chloroethylamine)	C03-A017
Methylbis(β-chloroethyl)amine	C03-A017
Methylbis(β-chloroethyl)amine Hydrochloride	C03-A017
Methylbisphenyl Isocyanate	C11-A113
Methyl-bladan	C11-A120
Methylbromid	C11-A110
Methylbromuer	C11-A110
Methylcarbamic Acid 2,3-(Isopropylidenedioxy)phenyl Ester	C11-A014
Methylcarbamic Acid, 2,3-(Dimethylmethylenedioxy)-phenyl Ester	C11-A014
Methylcarbonimide	C11-A117
Methylcarbonochloridate	C11-A111
Methylcarbylamine	C11-A117
Methylchloorcarbonaat	C11-A111
Methylchloorformiaat	C11-A111
Methylchlorcarbonat	C11-A111
Methylchlorformiat	C11-A111
Methylchloridocarbonate	C11-A111
Methylchloridophosphonic Acid 1,2,2-Trimethylpropyl Ester	C01-C055
Methylchlormethanat	C11-A111
Methylchlorocarbonate	C11-A111

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Methylchlorsilan	C11-A112
Methylchoroformate	C11-A111
Methyldi(2-chloroethyl)amine	C03-A017
Methyldiazane	C11-A116
Methyldichlorarsin	C04-A003
Methyldichlorarsine	C04-A003
Methyldichloroarsine	C04-A003
Methyldichlorophosphate	C01-C161
Methyldichlorophosphine	C01-C065
Methyldichlorophosphine Sulfide	C01-C066
Methyldick	C04-A003
Methyldiethanolamine	C03-C043
Methyldiethoxyphosphine	C01-C
Methyldifluorophosphine	C01-C
Methyle (Formiate de)	C11-A115
Methyle (Sulfate de)	C03-A009
Methyleendifenyldi-isocyanaat	C11-A113
Methyleen-S,S'-bis(O,O-diethyl-dithiofosfaat)	C11-A065
Methylendiphenylisocyanate	C11-A113
Methylene Bis(4-phenyl Isocyanate)	C11-A113
Methylene Bisphenyl Diisocyanate	C11-A113
Methylene Bisphenyl Isocyanate	C11-A113
Methylene Diphenyl Diisocyanate	C11-A113
Methylene Di-p-phenylene Isocyanate	C11-A113
Methylene Oxide	C11-A083
Methylenebis(4-phenylisocyanate)	C11-A113
Methylenebis[4-isocyanatobenzene]	C11-A113
Methylenebis[4-phenyl Isocyanate]	C11-A113
Methylenebis[para-phenyl Isocyanate]	C11-A113
Methylenebis[para-phenylene Isocyanate]	C11-A113
Methylenebis[p-phenyl Isocyanate]	C11-A113
Methylenebis[p-phenylene Isocyanate]	C11-A113
Methylenediphenyl Diisocyanate	C11-A113
Methylene-S,S'-bis(O,O-diaethyl-dithiophosphat)	C11-A065
Methylester Kyseliny Chlormravenci	C11-A111
Methylester Kyseliny Chloruhlicite	C11-A111
Methylester Kyseliny Fluoroctove	C11-A114
Methylester Kyseliny Mravenci	C11-A115
Methylethyleenimine	C11-A145
Methylethyleneimine	C11-A145
Methylethylenimine	C11-A145
Methylfluoroacetate	C11-A114
Methylfluorocyclohexylphosphonate	C01-A005
Methylfluorophosphoric Acid Isopropyl Ester	C01-A002
Methylfluoropinacolylphosphonate	C01-A003
Methylfluoropinacolylphosphonite	C01-A003
Methylfluorphosphorsaeureisopropylester	C01-A002
Methylfluorphosphorsaeurepinakolylester	C01-A003
Methylformate	C11-A115
Methylformiaat	C11-A115

Methylformiat	C11-A115
Methylgusathion	C11-A013
Methylhydrazine	C11-A116
Methylhydrazine (Mono)	C11-A116
Methylhydrogensulfid	C11-A118
Methylhydrosulfid	C11-A118
Methylidyne trichloride	C11-A043
Methylimino(oxidanylidene)methane	C11-A117
Methylimino(oxo)methane	C11-A117
Methyliminodiethanol	C03-C043
Methylisocyanaat	C11-A117
Methylisocyanate	C11-A117
Methylisokyanat	C11-A117
Methylisopropoxyfluorophosphine Oxide	C01-A002
Methylmercaptaan	C11-A118
Methylmercaptan	C11-A118
Methylmercuric Cyanoguanidine	C11-A119
Methylmercuric Dicyanamide	C11-A119
Methylmercuric Dicyandiamide	C11-A119
Methylmercury	C11-A060
Methylmercury Dicyandiamide	C11-A119
Methylmerkaptan	C11-A118
Methylmerkuridikyandiamid	C11-A119
Methylmerkuridikyandiamid]	C11-A119
Methyl-meta-phenylene Diisocyanate	C11-A174
Methylmethanoat	C11-A115
Methyl-m-phenylene Isocyanate	C11-A174
Methyl-N-{[(methylamino)carbonyl]oxy} Ethaanimidothioaat	C11-A107
Methyl-N',N'-dimethyl-N-[(methylcarbamoyl)oxy]-1-thio-oxamidat	C11-A147
Methyloxymethyl Chloride	C11-A044
Methylparathion	C11-A120
Methylphenyldichlorosilane	C11-A121
Methylphosphinothioic Dichloride	C01-C066
Methylphosphinyl Dichloride	C01-C065
Methylphosphinyl Difluoride	C01-C
Methylphosphonic Acid Dibutyl Ester	C01-C092
Methylphosphonic Acid Dichloride	C01-C052
Methylphosphonic Acid Isopropyl Ester	C01-D170
Methylphosphonic Acid Monoethyl Ester	C01-D168
Methylphosphonic Acid, Dibutyl Ester	C01-C092
Methylphosphonic Acid, Monocyclohexyl Ester	C01-C072
Methylphosphonic Dichloride	C01-C052
Methylphosphonic Difluoride	C01-C053
Methyl-Phosphonicacidiethylester	C01-C089
Methylphosphonochloridic Acid 1,2,2-Trimethylpropyl Ester	C01-C055
Methylphosphonodichloridic Acid	C01-C052
Methylphosphonofluoridic Acid	C01-D
Methylphosphonofluoridic Acid 1,2,2-Trimethylpropyl Ester	C01-A003
Methylphosphonofluoridic Acid Isopropyl Ester	C01-A002

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Methylphosphonofluoridic Acid, 3,3-Dimethyl-2-butyl Ester	C01-A003
Methylphosphonofluoridic Acid, Cyclohexyl Ester	C01-A005
Methylphosphonothioic Acid O,S-Diethyl Ester	C01-D169
Methylphosphonothioic Acid, S-[2-(Diisopropylamino)ethyl] Ester	C01-D177
Methylphosphonothioic Dichloride	C01-C066
Methylphosphonothioyl Dichloride	C01-C066
Methylphosphonous Difluoride	C01-C
Methylphosphonyl Chloride	C01-C052
Methylphosphonyl Dichloride	C01-C052
Methylphosphonyl Dichloride and Methylphosphonyl Difluoride Mixture	C01-C
Methylphosphonyl Difluoride	C01-C053
Methylphosphonylchlorofluoride	C01-C
Methylphosphonyldichlorothionite	C01-C
Methylphosphonyldifluoride	C01-C053
Methylphosphorodichloridate	C01-C161
Methylphosphoryl Difluoride	C01-C053
Methylphosphoryldifluoride	C01-C053
Methylpinacolyloxyfluorophosphine Oxide	C01-A003
Methylpinacolyloxyphosphonyl Fluoride	C01-A003
Methylplumban	C11-A170
Methylpropenal	C11-A047
Methylrhodanate	C11-A122
Methylrhodanid	C11-A122
Methylsalfocyanate	C11-A122
Methylsulfanium	C11-A118
Methylsulfhydrat	C11-A118
Methylsulfocyanate	C11-A122
Methylsulfonic Chloride	C11-A104
Methylsulfuryl Chloride	C10-A009
Methylsulphuryl Chloride	C10-A009
Methylthioalcohol	C11-A118
methylthiocyanate	C11-A122
Methylthiocyanide	C11-A122
Methylthiokyanat	C11-A122
Methylthiol	C11-A118
Methylthionophosphonic Dichloride	C01-C066
Methylthiophos	C11-A120
Methylthiophosphonic Acid Dichloride	C01-C066
Methylthiophosphonic Acid Ethyl Ester	C01-C069
Methylthiophosphonic Dichloride	C01-C066
Methyl-β,β-dichlorodiethylamine	C03-A017
Metidatió	C11-A105
Metidation	C11-A105
Metil (Formiato di)	C11-A115
Metil Format	C11-A115
Metil Fume	C11-A110
Metil Hloroformat	C11-A111
Metil Isocianato	C11-A117
Metil Isosianat	C11-A117
Metil Izocijanat	C11-A117

Metil Mercaptan	C11-A118
Metil Merkaptan	C11-A118
Metil Parathion	C11-A120
Metil Paratión	C11-A120
Metil Sulfidrato	C11-A118
Metil Tiocijanat	C11-A122
Metil Viologeno Dicloruro	C11-A132
Metilaldeide	C11-A083
Metilamin	C11-A109
Metilamina	C11-A109
Metilamine	C11-A109
Metilammina	C11-A109
Metil-bromid	C11-A110
Metilcloro Carbonato	C11-A111
Metilcloroformiato	C11-A111
Metile Bromuro	C11-A110
Metilen Difenil Diizocijanat	C11-A113
Metilena Difenil Diisosianat	C11-A113
Metilendifenildiisocianato	C11-A113
Metilendifenilediisocianato	C11-A113
Metilformiat	C11-A115
Metilhidrazina	C11-A116
Metilmercaptan	C11-A118
Metilmercaptano	C11-A118
Metilmetanoato	C11-A115
Metiltriazotion	C11-A013
Metilživin Dicijanamid	C11-A119
Metiocarb	C11-A106
Metiokarb	C11-A106
Metiol	C11-A118
Metmercapturan	C11-A106
Metmercapturon	C11-A106
Metomil	C11-A107
Metomilo	C11-A107
Metossicarbonil Cloruro	C11-A111
Metram	C01-A014
Metramac	C01-A014
Metramatic	C01-A014
Metron	C11-A120
Metyl Fomat	C11-A115
Metylamin	C11-A109
Metylbromid	C11-A110
Metylformiat	C11-A115
Metylhydrazin	C11-A116
Metylisocyanat	C11-A117
Metylkarbylamin	C11-A117
Metylmerkaptan	C11-A118
Metylmetanoat	C11-A115
Metyloamina	C11-A109

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Metylohydrazyna	C11-A116
Metylu Bromek	C11-A110
Metyyliklooriformiaatti	C11-A111
Mevidrin	C11-A123
Mevinfos	C11-A123
Mevinox	C11-A123
Mevinphos	C11-A123
MF	C01-D
MFA	C11-A078
MFA	C11-A114
MFI	C01-A002
MH	C11-A116
MIC	C11-A117
Micowetsulf	C01-C061
Microflotox	C01-C061
Microsulf	C01-C061
Microthiol	C01-C061
Midas 101	C01-C061
Mie Duo Wei	C11-A107
Millon's Reagent	C11-A097
Mineral Green	C11-A046
MIPA	C01-C100
Mirror Ox	C11-A071
Mitis Green	C11-A046
Mitoxine	C03-A017
Mixture of O-Demeton and S-Demeton	C11-A050
Mixture of Sulfuric Acid and Sulfur Trioxide	C11-A157
MKIIIB	C04-A002
MKS	C01-C103
MLS001050112	C11-A010
MLS002207243	C11-A051
MLS002454390	C11-A017
MLS002695975	C11-A013
MLS002695987	C11-A065
MMA	C11-A109
MMD	C11-A119
MMH	C11-A116
MO	C03-A001
Mobisyl	C03-C045
Mole Death	C11-A159
Molecular Bromine	C10-A002
Molecular Chlorine	C10-A001
Molecular Fluorine	C11-A076
Molybdenum Phosphorus Hydroxide Oxide	C11-A124
Molybdophosphoric Acid	C11-A124
MOM-Cl	C11-A044
Mondur TD	C11-A173
Mondur-TD	C11-A174
Monicil	C11-A125
Monitor	C11-A103

Mono(1-methylethyl) P-Methyl-phosphonic Acid Ester;	C01-D170
Monoallylamine	C11-A005
Monobróm-metán	C11-A110
Monobrommethane	C11-A110
Monobromometano	C11-A110
Monobromomethane	C11-A110
Monochloracetonitril	C11-A041
Monochlorethen	C11-A180
Monochlorethylen	C11-A180
Monochlorhydrine du Glycol	C03-C041
Monochloroacetaldehyde	C11-A040
Monochloroacetic Acid Chloride	C11-A042
Monochloroacetonitrile	C11-A041
Monochloroacetyl Chloride	C11-A042
Monochlorodimethyl Ether	C11-A044
Monochloroethene	C11-A180
Monochloroethyene	C11-A180
Monochloroethylene	C11-A180
Monochloromethyl Ether	C10-A011
Monochloromethyl Methyl Ether	C11-A044
Monochlorosulfonic Acid	C11-A045
Monochlorosulfuric Acid	C11-A045
Monochlorotrifluoroethylene	C11-A177
Monochlortrifluorethylen	C11-A177
Monocil	C11-A125
Monocloruro de Etileno	C11-A180
Monocos	C11-A125
Monocron	C11-A125
Monocrotofos	C11-A125
Monocrotophos	C11-A125
Monocyclohexyl Methylphosphonate	C01-C072
Monocyclohexylamine	C11-A048
Monodrin	C11-A125
Monoethyl Amine	C11-A068
Monoethyl Methylphosphonate	C01-D168
Monoethylmercury Chloride	C11-A073
Monofluoracetato de Sódio	C11-A152
Monofluorättiksyra	C11-A078
Monofluorazijnzuur	C11-A078
Monofluoressigsäure	C11-A078
Monofluoressigsaures Natrium	C11-A152
Monofluorethanol	C11-A079
Monofluoroacetamide	C11-A077
Monofluoroacetate	C11-A078
Monofluoroacetato de Sodio	C11-A152
Monofluoroacetic Acid	C11-A078
Monofluoroethanol	C11-A079
Monofluoromethylphosphonic Acid	C01-D
Monofluorotrichloromethane	C11-A081

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Monofosfaan	C11-A139
Monohydro-chloride	C11-A088
Monoisopropyl Methylphosphonate	C01-D170
Monoisopropylamine	C01-C100
Monokrotofos	C11-A125
Monokrotofosz	C11-A125
Monomercury Nitrate	C11-A099
Monomethyl Amine	C11-A109
Monomethyl Hydrazine	C11-A116
Monometilamina	C11-A109
Monometilidrazina	C11-A116
Monometylamin	C11-A109
Monometylhydrazin	C11-A116
Monometylohydrazyna	C11-A116
Mononitrogen Monoxide	C11-A127
Monooxirane	C11-A071
Monophosphan	C11-A139
Monossido di Azoto	C11-A127
Monostar	C11-A125
Monostiban	C11-A153
Monosulfur Dichloride	C03-C039
Monosulphur Dichloride	C03-C039
Monovinyl Chloride	C11-A180
Monoxid de Azot	C11-A127
Monoxide	C09-A001
Monóxido de Azoto	C11-A127
Monoxido de Nitrogeno	C11-A127
Mônôxít Nitơ	C11-A127
Monoxyde D'azote	C11-A127
Montroidita	C11-A098
Montroydite	C11-A098
Mopari	C11-A055
Moquinete	C07-A003
Morbicid	C11-A083
Moropal	C11-A167
Morphos	C11-A120
Morsodren	C11-A119
Morton EP-227	C11-A119
Morton Soil Drench	C11-A119
Mortopal	C11-A167
Moss Green	C11-A046
Mostaza Lewisita	C03-A010
Mostaza Nitrogenada HN3	C03-A018
Mountain Green	C11-A046
Mouse-nots	C11-A159
Mouse-rid	C11-A159
Mouse-tox	C11-A159
MPA	C01-C060
M-Parathion	C11-A120
MPC	C01-C052

MPCF	C01-C
MPF	C01-C053
MPFA	C01-D
MPS	C01-C
MPT	C01-A017
MQD255M2ZO	C07-C008
Mravencan Methylnaty	C11-A115
Mrówczan Metylu	C11-A115
Mrowkozol	C11-A143
MS	C03-A010
MsCl	C11-A104
MTD	C11-A103
m-Toluene Diisocyanate	C11-A173
m-Tolylene Diisocyanate	C11-A173
m-Tolylene Diisocyanate	C11-A174
m-Tolylidene diisocyanate	C11-A174
Multamat	C11-A014
Multimet	C11-A014
Murfos	C11-A133
Murphos	C11-A133
Mustard	C03-A001
Mustard 1	C04-A002
Mustard and O-Mustard Mixture	C03-A005
Mustard and T Mixture	C03-A005
Mustard Essential Oils	C11-A007
Mustard Gas	C03-A001
Mustard Gas Sulfone	C03-D055
Mustard Gas Sulfoxide	C03-D056
Mustard HD	C03-A001
Mustard Lewisite Mixture	C03-A010
Mustard Oil	C11-A007
Mustard Seed Oil	C11-A007
Mustard Sulfone	C03-D055
Mustard Sulfoxide	C03-D056
Mustard Sulfur	C03-A001
Mustard Sulphone	C03-D055
Mustard Sulphoxide	C03-D056
Mustard T Mixture	C03-A005
Mustargen	C03-A017
Mustargen Hydrochloride	C03-A017
Mustine	C03-A017
Mustine Hydrochloride	C03-A017
Mustine Note	C03-A017
Mutagen	C03-A017
Muthmann's Liquid	C11-A164
Muthmanns Flüssigkeit	C11-A164
MV2625000	C11-A059
MV5600000	C11-A116
MW3760000	C11-A090

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MW3850000	C11-A087
MW4025000	C11-A088
MW6825000	C07-A001
MX1050000	C11-A091
MX1225000	C07-A006
MXP	C01-C061
Mylox	C01-C061
Myrsyrametylester	C11-A115
- N -	
(N,N-Diisopropylamino)ethanol	C01-C104
[(N-Cyanocarbamimidoyl)amino]-methyl-mercury	C11-A119
N	C10-A004
N (Arsine Oil)	C04-A
N (German WW II)	C10-A015
N-(((Methylamino)carbonyl)oxy)ethanimidothioic Acid Methyl Ester	C11-A107
N-((Isopropylimino)methylene)propan-2-amine	C01-C058
N-((Isopropylimino)methyl-ene)propan-2-amine	C01-C058
N-(1-Methylethyl)-2-propamine	C01-D174
N-(1-Methylethyl)-2-propanamine	C01-D174
N-(2-([2-(Diisopropylamino)ethyl]disulfanyl)ethyl)-N-isopropyl-2-propanamine	C01-D167
N-(2-([2-(Diisopropylamino)ethyl]sulfanyl)ethyl)-N-isopropyl-2-propanamine	C01-D166
N-(2-{[Ethoxy(methyl)phosphoryl]sulfanyl}ethyl)-N-(1-methylethyl)propan-2-aminium Chloride	C01-A017
N-(2-{[Ethoxy(methyl)phosphoryl]sulfanyl}ethyl)-N-(isopropyl)propan-2-aminium Chloride	C01-A017
N-(2-{[Ethoxy(methyl)phosphoryl]sulfanyl}ethyl)-N-1-methylethyl-N-methylpropan-2-aminium Iodide	C01-A017
N-(2-{[Ethoxy(methyl)phosphoryl]sulfanyl}ethyl)-N-isopropyl-N-methylpropan-2-aminium Iodide	C01-A017
N-(2-{[Ethoxy(methyl)phosphoryl]sulfanyl}ethyl)-N-isopropylpropan-2-aminium Chloride	C01-A017
N-(2-Chloroethyl)diisopropylamine	C01-C
N-(2-Chloroethyl)dimethylamine	C01-C099
N-(2-Chloroethyl)dimethylamine Hydrochloride	C01-C099
N-(2-Chloroethyl)-N-(1-methylethyl)-2-propaneamine	C01-C
N-(2-Chloroethyl)-N-(isopropyl)-2-propaneamine	C01-C
N-(2-Chloroethyl)-N,N-diisopropylamine	C01-C
N-(2-Chloroethyl)-N,N-dimethylamine	C01-C099
N-(2-Chloroethyl)-N,N-dimethylamine Hydrochloride	C01-C099
N-(2-Chloroethyl)-N,N-dimethylammonium Chloride	C01-C099
N-(2-Chloroethyl)-N-isopropylpropan-2-aminium Chloride	C01-C
N-(2-Chloroethyl)-N-methyl-2-chloropropylamine	C03-A025
N-(2-Hydroxyethyl)diethylamine	C01-C103
N-(2-Hydroxyethyl)-N-methylethanolamine	C03-C043
N-(Dichloromethylene)aniline	C10-A013
N-(Dichloromethylidene)hydroxylamine	C05-A001
N-(Diethylamino)ethanol	C01-C103
N-(Isopropyl)-2-propamine	C01-D174
N-(Isopropyl)-2-propanamine	C01-D174
N-(Phenylimino)phosgene	C10-A013
N,N Dimethylamine	C01-C098
N,N-(2-Diisopropylamino)ethanethiol	C01-C105
N,N,2-Trimethylpropanamidine {Novichok Precursor}	C01-C
N,N,N,N-Tetramethylphosphorodiamidic Fluoride	C11-A058
N,N,N',N'-Tetramethyl-diamido-fluor-phosphin-oxid	C11-A058

N,N,N',N'-Tetramethyl-diamido-fosforzuur-fluoride	C11-A058
N,N,N',N'-Tetramethyl-diamido-phosphorsaeure-fluorid	C11-A058
N,N,N',N'-Tetramethylphosphorodiamidic Fluoride	C11-A058
N,N,N',N'-Tetrametil-fosforodiammido-fluoruro	C11-A058
N,N,N-Trifluoroamine	C11-A129
N,N,N-Trimethylamine	C11-A178
N,N,N-Tris(2-chloroethyl)amine	C03-A018
N,N'-(Dithio-2,1-ethanediyl)bis(N-1-methylethyl)-2-propanamine	C01-D167
N,N'-(Dithio-2,1-ethanediyl)bis(N-isopropyl)-2-propanamine	C01-D167
N,N'-(Dithiobisethylene)bis(diisopropylamine)	C01-D167
N,N'-(Thiodi-2,1-ethanediyl)bis[N-(1-methylethyl)-2-propanamine	C01-D166
N,N'-(Thiodi-2,1-ethanediyl)bis[N-(isopropyl)-2-propanamine	C01-D166
N,N'-[Disulfanediyldi(ethane-2,1-diyl)]bis[N-(propan-2-yl)propan-2-amine]	C01-D167
N,N'-[Sulfanediyldi(ethane-2,1-diyl)]bis[N-(propan-2-yl)propan-2-amine]	C01-D166
N,N'-Di(propan-2-yl)methanediimine	C01-C058
N,N'-Dicyclohexyl Urea	C01-D171
N,N'-Dicyclohexylcarbodiimide	C01-C056
N,N'-Diisopropyl Carbodiimide	C01-C058
N,N'-Diisopropylmethanediimine	C01-C058
N,N'-Dimethyl-4,4'-bipyridylium Dichloride	C11-A132
N,N'-Dimethyl-gamma,gamma'-bipyridylium Dichloride	C11-A132
N,N'-Dimethylhydrazine	C11-A059
N,N'-Dimethyl-γ,γ'-bipyridylium Dichloride	C11-A132
N,N'-Dimetyl-4,4'-bipyridindiklorid	C11-A132
N,N'-Dipropan-2-ylcarbodiimide	C01-C058
N,N'-Iminodiethanol	C03-D060
N,N'-Methanediylidenebis(propan-2-amine)	C01-C058
N,N'-Methanetetrayl Biscyclohexanamine	C01-C056
N,N'-Methanetetraylbis(1-methylethylamine)	C01-C058
N,N'-Methanetetraylbis[cyclohexanamine]	C01-C056
N,N'-Methanetetraylbiscyclohexanamine	C01-C056
N,N'-Thiodi-2,1-ethanediyl Bis(N-1-methylethyl)-2-propanamine	C01-D166
N,N'-Thiodi-2,1-ethanediyl Bis(N-isopropyl)-2-propanamine	C01-D166
N,N'-Диметил-4,4'-дипиридилия Дихлорида	C11-A132
N,N'-Dimethyl-4,4'-bipyridinium Dichloride	C11-A132
N,N-Bis(2-chloroethyl) (1-Methylethyl)amine	C03-A029
N,N-Bis(2-chloroethyl) (Isopropyl)amine	C03-A029
N,N-Bis(2-chloroethyl) 1,1-Dimethylethylamine	C03-A033
N,N-Bis(2-chloroethyl) 1-Methylpropylamine	C03-A035
N,N-Bis(2-chloroethyl) 2-Methylpropylamine	C03-A034
N,N-Bis(2-chloroethyl) 2-Propanamine	C03-A029
N,N-Bis(2-chloroethyl) Butylamine	C03-A036
N,N-Bis(2-chloroethyl) Isobutylamine	C03-A035
N,N-Bis(2-chloroethyl) Isopropylamine	C03-A029
N,N-Bis(2-chloroethyl) n-Propylamine	C03-A030
N,N-Bis(2-chloroethyl) Propylamine	C03-A030
N,N-Bis(2-chloroethyl) s-Butylamine	C03-A034
N,N-Bis(2-chloroethyl) sec-Butylamine	C03-A034
N,N-Bis(2-chloroethyl) t-Butylamine	C03-A033

(*Continued*)

N,N-Bis(2-chloroethyl) tert-Butylamine	C03-A033
N,N-Bis(2-chloroethyl)-1-butanamine	C03-A036
N,N-Bis(2-chloroethyl)-2-butanamine	C03-A034
N,N-Bis(2-chloroethyl)-2-fluoroethanamine	C03-A022
N,N-Bis(2-chloroethyl)-2-methyl-1-propanamine	C03-A035
N,N-Bis(2-chloroethyl)-2-propen-1-amine	C03-A027
N,N-Bis(2-chloroethyl)butan-1-amine	C03-A036
N,N-Bis(2-chloroethyl)butylamine	C03-A036
N,N-Bis(2-chloroethyl)ethanamine	C03-A016
N,N-Bis(2-chloroethyl)methanamine Hydrochloride	C03-A017
N,N-Bis(2-chloroethyl)methylamine	C03-A017
N,N-Bis(2-chloroethyl)-n-butylamine	C03-A036
N,N-Bis(2-chloroethyl)-N-ethylamine	C03-A016
N,N-Bis(2-chloroethyl)-N-methylamine	C03-A017
N,N-Bis(2-chloroethyl)propan-1-amine	C03-A030
N,N-Bis(2-chloroethyl)propan-2-amine	C03-A029
N,N-Bis(2-chloroethyl)propylamine	C03-A030
N,N-Bis(2-chloropropyl)-N-methylamine	C03-A031
N,N-Bis(2-chloropropyl)-N-methylammonium Chloride	C03-A031
N,N-Bis(2-hydroxyethyl)amine	C03-D060
N,N-Bis(2-hydroxyethyl)ethylamine	C03-C044
N,N-Bis(2-hydroxyethyl)methylamine	C03-C043
N,N-Di(2-hydroxyethyl)-N-methylamine	C03-C043
N,N-Di(chloroethyl)methylamine	C03-A017
N,N-Di(hydroxyethyl)amine	C03-D060
N,N-Diaethyl-propionamidin {Novichok Precursor}	C01-C
N,N-Dibutyl-1-butanamine	C01-C067
N,N-Diethanolamine	C03-D060
N,N-Diethyl Acetamidine	C01-C107
N,N-Diethyl Amine	C01-C097
N,N-Diethyl(2-hydroxyethyl)amine	C01-C103
N,N-Diethyl-2-{[methyl(cyclohexyloxy)phosphoryl]sulfanyl}-N-methylethanaminium Iodide	C01-A021
N,N-Diethyl-2-aminoethanol	C01-C103
N,N-Diethyl-2-methyl-propanamidine {Novichok Precursor}	C01-C
N,N-Diethylacetamidin	C01-C107
N,N-Diethyl-acetamidin	C01-C107
N,N-Diethylacetamidine	C01-C107
N,N-Diethyl-acetamidine	C01-C107
N,N-Diethylamine	C01-C097
N,N-Diethylaminoethanol	C01-C103
N,N-Diethylbutanamidine {Novichok Precursor}	C01-C
N,N-Diethylbutanimidamide {Novichok Precursor}	C01-C
N,N-Diethylbutyramidine {Novichok Precursor}	C01-C
N,N-Diethylethanimidamide	C01-C107
N,N-Diethyl-formamidin {Novichok Precursor}	C01-C
N,N-Diethylformamidine {Novichok Precursor}	C01-C
N,N-Diethylisobutanamidine {Novichok Precursor}	C01-C
N,N-Diethylisobutanimidamide {Novichok Precursor}	C01-C
N,N-Diethylisobutyramidine {Novichok Precursor}	C01-C
N,N-Diethylmethanimidamide {Novichok Precursor}	C01-C

N,N-Diethylmonoethanolamine	C01-C103
N,N-Diethyl-N-(beta-hydroxyethyl)amine	C01-C103
N,N-Diethyl-N-(β-hydroxyethyl)amine	C01-C103
N,N-Diethyl-N'-[fluoro(methoxy)phosphoryl]acetamidine	C01-A037
N,N-Diethyl-N'-[fluoro(methoxy)phosphoryl]ethanimidamide	C01-A037
N,N-Diethyl-N'-[fluoro(methyl)phosphoryl]acetamidine	C01-A036
N,N-Diethylpropanamidine {Novichok Precursor}	C01-C
N,N-Diisopropyl Ethanolamine	C01-C104
N,N-Diisopropyl-(b)-aminoethanol	C01-C104
N,N-Diisopropyl-(beta)-aminoethanol	C01-C104
N,N-Diisopropyl-(beta)-aminoethyl Chloride	C01-C
N,N-Diisopropyl-(β)-aminoethanol	C01-C104
N,N-Diisopropyl-(β)-aminoethyl Chloride	C01-C
N,N-Diisopropyl-2-aminoethanol	C01-C104
N,N-Diisopropyl-2-aminoethyl Chloride	C01-C
N,N-Diisopropyl-2-chloroethylamine	C01-C
N,N-Diisopropylamine	C01-D174
N,N-Diisopropylaminoethane-2-ol	C01-C104
N,N-Diisopropylaminoethane-2-thiol	C01-C105
N,N-Diisopropylaminoethanethiol	C01-C105
N,N-Diisopropylaminoethanol	C01-C104
N,N-Diisopropylaminoethyl-2-chloride	C01-C
N,N-Diisopropylbutanamidine {Novichok Precursor}	C01-C
N,N-Diisopropylbutanimidamide {Novichok Precursor}	C01-C
N,N-Diisopropylbutyramidine {Novichok Precursor}	C01-C
N,N-Diisopropylethanolamine	C01-C104
N,N-Diisopropylethylamine	C01-D176
N,N-Diisopropyl-formamidin {Novichok Precursor}	C01-C
N,N-Diisopropylformamidine {Novichok Precursor}	C01-C
N,N-Diisopropylmethanimidamide {Novichok Precursor}	C01-C
N,N-Diisopropyl-β-aminoethyl chloride	C01-C
N,N-Dimethyl Aminoethyl-2-chloride	C01-C099
N,N-Dimethyl Carbamoyl Chloride	C02-C052
N,N-Dimethyl Carbamyl Chloride	C02-C052
N,N-Dimethyl Phosphoramidic Dichloride	C01-C162
N,N-Dimethyl-2-chloroethanamine Hydrochloride	C01-C099
N,N-Dimethyl-2-chloroethylamine	C01-C099
N,N-Dimethyl-2-chloroethylamine Hydrochloride	C01-C099
N,N-Dimethyl-2-methyl-carbamoyloximino-2-(dimethylthio) Acetamide	C11-A147
N,N-Dimethylacetamidine {Novichok Precursor}	C01-C
N,N-Dimethyl-alpha-methylcarbamoxyloxyimino-alpha-(methylthio)acetamide	C11-A147
N,N-Dimethyl-alpha-methylcarbamoyloxyimino-alpha-(methylthio)acetamide	C11-A147
N,N-Dimethylaminoethyl-2-chloride	C01-C099
N,N-Dimethylaminoethyl-2-chloride Hydrochloride	C01-C099
N,N-Dimethylaminoformyl Chloride	C02-C052
N,N-Dimethylaminophosphoryl Dichloride	C01-C162
N,N-Dimethyl-beta-chloroethylamine	C01-C099
N,N-Dimethylbutanamidine {Novichok Precursor}	C01-C
N,N-Dimethylbutanimidamide {Novichok Precursor}	C01-C

(*Continued*)

N,N-Dimethylbutyramidine {Novichok Precursor}	C01-C
N,N-Dimethylcarbamic Acid Chloride	C02-C052
N,N-Dimethylcarbamic Chloride	C02-C052
N,N-Dimethylcarbamidoyl Chloride	C02-C052
N,N-Dimethylcarbamoyl Chloride	C02-C052
N,N-Dimethylchloroformamide	C02-C052
N,N-Dimethylethanimidamide {Novichok Precursor}	C01-C
N,N-Dimethylformamidine {Novichok Precursor}	C01-C
N,N-Dimethylisobutanamidine {Novichok Precursor}	C01-C
N,N-Dimethylisobutanimidamide {Novichok Precursor}	C01-C
N,N-Dimethylisobutyramidine {Novichok Precursor}	C01-C
N,N-Dimethylmethanamine	C11-A178
N,N-Dimethylmethanimidamide {Novichok Precursor}	C01-C
N,N-Dimethyl-N-(2-chloroethyl)amine	C01-C099
N,N-Dimethyl-N-(2-chloroethyl)amine Hydrochloride	C01-C099
N,N-Dimethyl-O,O'-diethylphosphoramidate	C01-C
N,N-Dimethylphosphoramidic Dichloride	C01-C162
N,N-Dimethylphosphoramidodichloridate	C01-C162
N,N-Dimethylpropanamidine {Novichok Precursor}	C01-C
N,N-Dimethylpropanimidamide {Novichok Precursor}	C01-C
N,N-Dimethyl-α-methylcarbamoyloxyimino-α-(methylthio)acetamide	C11-A147
N,N-Dimethyl-β-chloroethylamine	C01-C099
N,N-Dimetilmetanamina	C11-A178
N,N-Dimetilmetanammina	C11-A178
N,N-Dimetyylimetaaniamiini	C11-A178
N,N-Dipropylacetamidine {Novichok Precursor}	C01-C
N,N-Dipropylbutanamidine {Novichok Precursor}	C01-C
N,N-Dipropylbutanimidamide {Novichok Precursor}	C01-C
N,N-Dipropylbutyramidine {Novichok Precursor}	C01-C
N,N-Dipropylethanimidamide {Novichok Precursor}	C01-C
N,N-Dipropyl-formamidin {Novichok Precursor}	C01-C
N,N-Dipropylformamidine {Novichok Precursor}	C01-C
N,N-Dipropylisobutanamidine {Novichok Precursor}	C01-C
N,N-Dipropylisobutanimidamide {Novichok Precursor}	C01-C
N,N-Dipropylisobutyramidine {Novichok Precursor}	C01-C
N,N-Dipropylmethanimidamide {Novichok Precursor}	C01-C
N,N-Dipropylpropanamidine {Novichok Precursor}	C01-C
N,N-Dipropylpropanimidamide {Novichok Precursor}	C01-C
N.N-Diethyl-acetamidin	C01-C107
N.N-Diethyl-propionamidin {Novichok Precursor}	C01-C
N.N-Dimethyl-propionamidin {Novichok Precursor}	C01-C
N.N-Dipropyl-propionamidin {Novichok Precursor}	C01-C
N-[(Chloroethoxyphosphinyl)oxy]-2,2-difluoro-2-nitroethanimidoyl Fluoride	C01-C127
N-[(Chloroethoxyphosphinyl)oxy]-2-methylpropanimidoyl Chloride	C01-C147
N-[(Chloroethoxyphosphinyl)oxy]ethanimidoyl Chloride	C01-C138
N-[(Chloroethoxyphosphinyl)oxy]propanimidoyl Chloride	C01-C141
N-[(Chloromethoxyphosphinyl)oxy]-2,2-difluoro-2-nitroethanimidoyl Fluoride	C01-C120
N-[(Chloropropoxyphosphinyl)oxy]-2-methylpropanimidoyl Chloride	C01-C152
N-[(Chloropropoxyphosphinyl)oxy]butanimidoyl Chloride	C01-C148
N-[(Chloropropoxyphosphinyl)oxy]ethanimidoyl Chloride	C01-C139

N-[(Chloropropoxyphosphinyl)oxy]propanimidoyl Chloride	C01-C146
N-[(Dichlorophosphinyl)oxy]-2,2-difluoro-2-nitroethanimidoyl Fluoride	C01-C113
N-[(Dichlorophosphinyl)oxy]-2-methylpropanimidoyl Chloride	C01-C131
N-[(Dichlorophosphinyl)oxy]butanimidoyl Chloride	C01-C132
N-[(Dichlorophosphinyl)oxy]ethanimidoyl Chloride	C01-C116
N-[(Dichlorophosphinyl)oxy]propanimidoyl Chloride	C01-C124
N-[(Ethoxyfluorophosphinyl)oxy]-2,2-difluoro-2-nitroethanimidoyl Fluoride	C01-A048
N-[(Methylcarbamoyl)oxy]thioacetimidic Acid Methyl Ester	C11-A107
N-[[(Methylamino)carbonyl]oxy]-2-(methylthio)ethanimine	C11-A107
N-[[(Methylamino)carbonyl]oxy]ethanimidothioic Acid Methyl Ester	C11-A107
N-[[Chloro(1-methylethoxy)phosphinyl]oxy]-2-methylpropanimidoyl Chloride	C01-C151
N-[[Chloro(1-methylethoxy)phosphinyl]oxy]butanimidoyl Chloride	C01-C150
N-[[Chloro(1-methylethoxy)phosphinyl]oxy]ethanimidoyl Chloride	C01-C140
N-[[Chloro(1-methylethoxy)phosphinyl]oxy]propanimidoyl Chloride	C01-C144
N-[[Chloro(2-methylpropoxy)phosphinyl]oxy]-2-methylpropanimidoyl Chloride	C01-C154
N-[[Chloro(2-methylpropoxy)phosphinyl]oxy]butanimidoyl Chloride	C01-C153
N-[[Chloro(2-methylpropoxy)phosphinyl]oxy]ethanimidoyl Chloride	C01-C145
N-[[Chloro(2-methylpropoxy)phosphinyl]oxy]propanimidoyl Chloride	C01-C149
N-[2-[2-(Dipropan-2-ylamino)ethyldisulfanyl]ethyl]-N-propan-2-yl-propan-2-amine	C01-D167
N-[2-[2-[Di(propan-2-yl)amino]ethylsulfanyl]ethyl]-N-propan-2-ylpropan-2-amine	C01-D166
N-[2-[Ethoxy(methyl)phosphanyl]oxyethyl]-N-propan-2-ylpropan-2-amine	C01-C064
N-[Bromo(ethoxy)phosphoryl]oxy-1-chloro-formimidoyl Fluoride	C01-C122
N-[Chloro(ethoxy)phosphoryl]oxy-1,1-difluoro-methanimine	C01-C126
N-[chloro(ethoxy)phosphoryl]oxy-2,2-difluoro-2-nitro-acetimidoyl fluoride	C01-C127
N-[Chloro(ethoxy)phosphoryl]oxy-2-methyl-propanimidoyl Chloride	C01-C147
N-[Chloro(ethoxy)phosphoryl]oxyacetimidoyl Chloride	C01-C138
N-[Chloro(ethoxy)phosphoryl]oxypropanimidoyl Chloride	C01-C141
N-[Chloro(isobutoxy)phosphoryl]oxy-2-methyl-propanimidoyl Chloride	C01-C154
N-[Chloro(isobutoxy)phosphoryl]oxyacetimidoyl Chloride	C01-C145
N-[Chloro(isobutoxy)phosphoryl]oxybutanimidoyl Chloride	C01-C153
N-[Chloro(isobutoxy)phosphoryl]oxypropanimidoyl Chloride	C01-C149
N-[Chloro(isopropoxy)phosphoryl]oxy-1,1-difluoro-methanimine	C01-C137
N-[Chloro(isopropoxy)phosphoryl]oxy-2-methyl-propanimidoyl Chloride	C01-C151
N-[Chloro(isopropoxy)phosphoryl]oxyacetimidoyl Chloride	C01-C140
N-[Chloro(isopropoxy)phosphoryl]oxybutanimidoyl Chloride	C01-C150
N-[Chloro(isopropoxy)phosphoryl]oxypropanimidoyl Chloride	C01-C144
N-[Chloro(methoxy)phosphoryl]oxy-1,1-difluoro-methanimine	C01-C118
N-[Chloro(methoxy)phosphoryl]oxy-2,2-difluoro-2-nitro-acetimidoyl Fluoride	C01-C120
N-[Chloro(propoxy)phosphoryl]oxy-1,1-difluoro-methanimine	C01-C136
N-[Chloro(propoxy)phosphoryl]oxy-2-methyl-propanimidoyl Chloride	C01-C152
N-[Chloro(propoxy)phosphoryl]oxyacetimidoyl Chloride	C01-C139
N-[Chloro(propoxy)phosphoryl]oxybutanimidoyl Chloride	C01-C148
N-[Chloro(propoxy)phosphoryl]oxypropanimidoyl Chloride	C01-C146
N-[Dimethylamino(fluoro)phosphoryl]-N-methylmethanamine	C11-A058
N-[Ethoxy-(3-methyl-4-methylsulfanylphenoxy)phosphoryl]propan-2-amine	C11-A074
N',N'-Diethyl-acetamidin	C01-C107
N',N'-Dimethylcarbamoyl(methylthio)methylenamine N-Methylcarbamate	C11-A147
N',N'-Dimethyl-N-((methylcarbamoyl)oxy)-1-methylthio-oxamimidic Acid	C11-A147
N',N'-Dimethyl-N-((methylcarbamoyl)oxy)-1-thiooxamimidic Acid Methyl Ester	C11-A147

(*Continued*)

N'-[Ethoxy(fluoro)phosphoryl]-N,N-diethyl-acetamidine	C01-A038
N'-Dimethylacetamidine {Novichok Precursor}	C01-C
N'-Dipropylacetamidine {Novichok Precursor}	C01-C
N',N'-Dimethylcarbamoyl(methylthio)-methylenamin-N-methylcarbamat	C11-A147
N1	C07-A001
N-2-Diethylaminomethylacetamidido-ethoxyphosphonofluoridate	C01-A038
Nacconate 100	C11-A173
NaEA 2192	C01-D177
Natri Asenat(III)	C11-A151
Natri Asenit	C11-A151
Natri Floacetat	C11-A152
Natri Monofloacetat	C11-A152
Natrijev Fluoroacetat	C11-A152
Natrijev Monofluoroacetat	C11-A152
Natrijum Arsenit	C11-A151
Natrijum Fluoracetat	C11-A152
Natrijum Fluoroacetat	C11-A152
Natrijum Monofluoracetat	C11-A152
Natrium Cyanide	C07-C009
Natriumarsenid	C08-C004
Natriumhexafluorosilicat	C01-C106
Natriummetaarsenit	C11-A151
Natriummonofluoressigsäure	C11-A152
Natriumsilicofluorid	C01-C106
Natural Montroydite	C11-A098
Navade	C11-A061
Navadel	C11-A061
Navron	C11-A077
n-BIC	C11-A028
N-Bis(2-hydroxyethyl)-N-ethylamine	C03-C044
n-Buty Chloroformate	C11-A026
n-Butyl Chlorocarbonate	C11-A026
N-Butylbis(2-chloroethyl)amine	C03-A036
n-Butylisocyanate	C11-A028
NC {Chloropicrin (75-80%) and Stannic Chloride (25-20%) Mixture}	C10-A006
NC 6897	C11-A014
n-Capryl Mercaptan	C11-A130
N-Chloro-2-propanamine	C01-D172
N-Chloroisopropylamine	C01-D172
N-Chloropropan-2-amine	C01-D172
NCI-C00066	C11-A013
NCI-C00395	C11-A061
NCI-C00533	C10-A006
NCI-C50215	C11-A002
NCI-C54773	C01-C085
NCI-C55174	C03-D060
NCI-C55221	C01-C077
NCI-C60219	C10-A003
N-Cyano-N'-(methylmercury)guanidine	C11-A119
N-Cyclohexyl(cyclohexylamino)carboxamide	C01-D171

N-Desmethyl Bidrin	C11-A125
N-Dibromomethylidenehydroxylamine	C05-A002
N-Dichlorophosphoryl-N-methylmethanamine	C01-C162
N-Dichlorophosphoryloxy-1,1-difluoro-methanimine	C01-C110
N-Dichlorophosphoryloxy-2,2-difluoro-2-nitro-acetimidoyl Fluoride	C01-C113
N-Dichlorophosphoryloxy-2-methyl-propanimidoyl Chloride	C01-C131
N-Dichlorophosphoryloxyacetimidoyl Chloride	C01-C116
N-Dichlorophosphoryloxybutanimidoyl Chloride	C01-C132
N-Dichlorophosphoryloxypropanimidoyl Chloride	C01-C124
N-Diclorofosforil-N-metilmetanamino	C01-C162
N-Diethylaminoethanol	C01-C103
N-Difluorophosphoryl-N-ethylethanamine	C01-C071
N-Diiodomethylene-hydroxylamine	C05-A003
N-Dijodmethylen-hydroxylamin	C05-A003
NE {Rhombic Sulfur and Silica Aerogel Mixture}	C01-C061
NE10571	C01-C059
Neantina	C11-A137
Nedcidol	C11-A051
Nefis	C11-A069
Nefrafos	C11-A055
Nema	C11-A136
Nemabrom	C11-A053
Nemacur	C11-A074
Nemafume	C11-A053
Nemagone	C11-A053
Nemanax	C11-A053
Nemanex	C11-A053
Nemapaz	C11-A053
Nemaset	C11-A053
Nemazon	C11-A053
Neocidol	C11-A051
Neodinon	C11-A051
Neosten	C01-C077
Neotsidol	C11-A051
Nephis	C11-A069
Nephocarp	C11-A036
Nera {Zinc Phosphide}	C11-A139
Nerkol	C11-A055
Nerve Gas No. 1	C01-A002
Nerve Gas No. 1	C07-A001
Nerve Gas No. 2	C07-A001
Nerve Gas No. 3	C07-A003
Nerve Gas No. 4	C01-A001
Netherlandshyl	C11-A013
N-Ethyl Amine	C11-A068
N-Ethyl-2,2'-iminodiethanol	C03-C044
N-Ethylbis(2-chloroethyl)amine	C03-A016
N-Ethylbis(2-chloroethyl)ammonium Chloride	C03-A016
N-Ethylbis(beta-chloroethyl)amine Hydrochloride	C03-A016

(*Continued*)

N-Ethylbis(β-chloroethyl)amine Hydrochloride	C03-A016
N-Ethyldiethanolamine	C03-C044
N-Ethyldiisopropylamine	C01-D176
N-Ethylethanamine	C01-C097
N-Ethyl-Ethanamine	C01-C097
N-Ethyl-N-(1-methylethyl)-2-propanamine	C01-D176
N-Ethyl-N-(isopropyl)-2-propanamine	C01-D176
N-Ethyl-N,N-di(2-hydroxyethyl)amine	C03-C044
N-Ethyl-N,N-diethanolamine	C03-C044
N-Ethyl-N,N-diisopropylamine	C01-D176
Nettle Gas	C05-A001
Netzschwefel	C01-C061
Neuwied Green	C11-A046
New Green	C11-A046
New Musigie	C11-A049
Nexagan	C11-A025
NG	C07-A006
NG2 {Hydrogen Sulfide (90%) and Carbon Disulfide (10%) Mixture}	C07-A006
N-H	C11-A009
NH-Lost	C03-A016
Niagara 1240	C11-A065
Nialate	C11-A065
Nichel Tetracarbonile	C09-A003
Nickel Carbonyl	C09-A003
Nickel Carbonyle	C09-A003
Nickel Tetracarbonyl	C09-A003
Nickel Tetracarbonyle	C09-A003
Nickle Carbonyl	C09-A003
Nifos	C11-A167
Nikkeltetracarbonyl	C09-A003
Niomil	C11-A014
Nipsan	C11-A051
Niran	C11-A133
N-Isopropyl-isopropylamine	C01-D174
Nital	C11-A126
Nitơ Điôxít	C11-A128
Nitơ Monooxit	C11-A127
Nitơ Monoxít	C11-A127
Nitofol	C11-A103
Nitol	C03-A017
Nitol Takeda	C03-A017
Nitrate Mercureux	C11-A099
Nitrate Mercurique	C11-A097
Nitrato de Mercurio(II)	C11-A097
Nitric Acid, Fuming	C11-A126
Nitric Acid, Mercury (1+) Salt	C11-A099
Nitric Acid, Mercury (I) Salt	C11-A099
Nitric Acid, Mercury Salt	C11-A097
Nitric Oxide	C11-A127
Nitrichloroform	C10-A006

Nitrile Acrilico	C11-A002
Nitrile Acrylique	C11-A002
Nitrilo-2,2,2-triethanol	C03-C045
Nitriloacetonitrile	C07-A005
Nitrilomethane	C07-A001
Nitrilotriethanol	C03-C045
Nitrilotris(ethanol)	C03-C045
Nitrinal	C11-A013
Nitrito	C11-A128
Nitro	C11-A128
Nitrobromoform	C10-A007
Nitrochloroform	C10-A006
Nitrogen Dioksid	C11-A128
Nitrogen Dioxide	C11-A128
Nitrogen Fluorida	C11-A129
Nitrogen Fluoride	C11-A129
Nitrogen Monooxide	C11-A127
Nitrogen Monoxide	C11-A127
Nitrogen Mustard 1	C03-A016
Nitrogen Mustard 2	C03-A017
Nitrogen Mustard 3	C03-A018
Nitrogen Mustard Gas -1	C03-A016
Nitrogen Oxide	C11-A127
Nitrogen Oxide	C11-A128
Nitrogen Peroxide	C11-A128
Nitrogen Tetroxide	C11-A128
Nitrogen Trifluorida	C11-A129
Nitrogen Trifluoride	C11-A129
Nitrogen(II) Oxide	C11-A127
Nitrogen(IV) Oxide	C11-A128
Nitrogen, Dihydrocyanide	C07-A001
Nitrogen, Monohydrocyanide	C07-A001
Nitrogendioxid	C11-A128
Nitrogenfluoride	C11-A129
Nitrogentrifluoride	C11-A129
Nitrogranulogen	C03-A017
Nitrogranulogen Hydrochloride	C03-A017
Nitrophenolthiophosphorsäureester	C11-A133
Nitro-sil	C11-A009
Nitrostigmine	C11-A133
Nitrostygmine	C11-A133
Nitrotribromomethane	C10-A007
Nitrotrichloromethane	C10-A006
Nitrous Fumes	C11-A126
Nitrox	C11-A120
Nitryl Hydroxide	C11-A126
Niuif 100	C11-A133
NJ6700000	C10-A013
NL	C03-A018

(*Continued*)

N-Lost	C03-A017
N-Lost	C03-A018
NM	C01-C062
NM	C03-A017
NM5	C01-C062
NME	C11-A109
N-Methyhydrazine	C11-A116
N-Methyl Amine	C11-A109
N-Methyl-2,2'-dichlorodiethylamine	C03-A017
N-Methyl-2,2'-dihydroxydiethylamine	C03-C043
N-Methyl-2,2'-iminodiethanol	C03-C043
N-Methyl-2-isopropoxyphenylcarbamate	C11-A143
N-Methylaminodiglycol	C03-C043
N-Methylbenzazimide, Dimethyldithiophosphoric Acid Ester	C11-A013
N-Methylbis(2-chloroethyl)amine	C03-A017
N-Methylbis(2-chloroethyl)amine Hydrochloride	C03-A017
N-Methylbis(2-hydroxyethyl)amine	C03-C043
N-Methylbis(Beta-chloroethyl)amine	C03-A017
N-Methylbis(β-chloroethyl)amine	C03-A017
N-Methyl-bis-chloraethylamin	C03-A017
N-Methylcarbamic Acid (2,2-Dimethyl-3H-benzofuran-7-yl) Ester	C11-A032
N-Methylcarbamoyloxime, 2-Methyl-2-methylsulfinylpropionaldehyde	C11-A003
N-Methylcarbamoyloxime, 2-Methylthio-2-methylpropionaldehyde	C11-A003
N-Methyldiethanolamine	C03-C043
N-Methyldiethanolimine	C03-C043
N-Methylhydrazine	C11-A116
N-Methylimino-2,2'-diethanol	C03-C043
N-Methyliminodiethanol	C03-C043
N-Methyl-Lost	C03-A017
N-Methylmethanamine	C01-C098
N-Metil Idrazina	C11-A116
N-Metilamina	C11-A109
N-Metylokarbaminian 2,3-Dwuwodoro-2,2-Dwumetylobenzofuranylu-7	C11-A032
N-Mthyldiethanolamine	C03-C043
NN1750000	C07-A004
No. 4 (French WWI Shell) {Hydrogen Cyanide (50%), Arsenic Trichloride (30%), Stannic Chloride (15%) and Chloroform (5%) Mixture}	C07-A
No. 4B (French WWI Shell) {Cyanogen Chloride and Arsenic Trichloride Mixture}	C07-A
No. 4B (French WWI Shell) {Hydrogen Cyanide (50%) and Arsenic Trichloride (50%) Mixture}	C07-A
No. 5 (French WWI Shell) {Phosgene}	C10-A003
No. 5 (French WWI Shell) {Phosgene (60%) and Arsenic Trichloride (40%) Mixture}	C10-A
No. 5 (French WWI Shell) {Phosgene (75-66%) and Stannic Chloride (25-33%) Mixture}	C10-A003
No. 7 (French WWI Shell) {Chloropicrin (75-80%) and Stannic Chloride (25-20%) Mixture}	C10-A006
No. 13 (French WWI Shell) {Ethyl Chlorosulfonate (75%) and Stannic Chloride (25%) Mixture}	C10-A010
No. 16 (French WWI Shell) {Dimethyl Sulfate (75%) and Chlorosulfonic Acid (25%) or Methyl Chlorosulfonate (25%) Mixture}	C03-A
No. 20 (French WWI Shell)	C03-A001
NO4900000	C09-A002
n-Oct-1-yl mercaptan	C11-A130
n-Octanethiol	C11-A130

n-Octanethiolate	C11-A130
n-Octyl Mercaptan	C11-A130
n-Octyl Thiol	C11-A130
Nogos	C11-A055
n-Oktyylimerkaptaani	C11-A130
NOM	C11-A130
No-Pest	C11-A055
No-Pest Strip	C11-A055
NOR Nitrogen Mustard	C03-A016
Nordhausen Acid	C11-A157
Norforms	C11-A137
normal-BIC	C11-A028
normal-Buty Chloroformate	C11-A026
normal-Butyl Chlorocarbonate	C11-A026
normal-Butyl Isocyanate	C11-A028
normal-Propanenitrile	C11-A142
normal-Propyl Chloroformate	C11-A144
Nourithion	C11-A133
Novichok 5 (Binary agent based on A-232)	C01-A037
Novichok 7 (Binary agent based on A-234)	C01-A038
Novotox	C11-A055
N-Phenylcarbimide Dichloride	C10-A013
N-Phenylcarbonimidic Dichloride	C10-A013
N-Phenyldichloromethanimine	C10-A013
N-Phenylimidophosgene	C10-A013
N-Phenylimidoyl Dichloride	C10-A013
N-Phenylimino Carbonyl Dichloride	C10-A013
N-Phenyliminocarbonyl Dichloride	C10-A013
n-Propanenitrile	C11-A142
n-Propyl Chlorocarbonate	C11-A144
n-Propyl Chloroformate	C11-A144
NQ8250000	C11-A028
NQ8300000	C11-A029
NQ9230000	C11-A094
NQ9450000	C11-A117
N-Stoff (German WW II)	C10-A015
N-Stoff {Sulfur Trioxide (50%) and Trinitrotoluene (50%)}	C11-A156
NT8400000	C01-C100
N-t-Butyl Bis(2-chloroethyl)amine	C03-A033
N-t-Butyl-di(2-chloroethyl)amine	C03-A033
N-tert-Butyl Bis(2-chloroethyl)amine	C03-A033
N-tert-Butyl-di(2-chloroethyl)amine	C03-A033
N-Trimethylamine	C11-A178
Nu-bait II	C11-A107
Nucidol	C11-A051
Nudrin	C11-A107
Nufluor	C01-C077
Nuva	C11-A055
Nuvacron	C11-A125

(*Continued*)

Nuvan	C11-A055
Nuvos	C11-A055
NX8225000	C11-A007
Nylmerate	C11-A137
N-Yperit	C03-A018
- O -	
(O,O-Dimethyl)-S-(-2-methoxy-Δ2-1,3,4-thiadiazolin-5-on-4-ylmethyl)dithiophosphate	C11-A105
O	C03-A001
O-(2,2-Dichlorvinyl)-O,O-dimethylphosphat	C11-A055
O-(2,2-Dichlorvinyl)-O,O-dimethylphosphate	C11-A055
O-(2-Diisopropylaminoethyl) O'-Ethyl Methylphosphonite	C01-C064
O-(2-Isopropoxyphenyl) N-Methylcarbamate	C11-A143
O-(2-Methoxycarbonyl-1-methylvinyl)-O,O-dimethylphosphat	C11-A123
O-(2-Methylpropyl) S-(2-Diethylaminoethyl)methyl Phosphothioate	C01-A016
O-(2-Methylpropyl) S-(2-Diethylaminoethyl)methyl Thiophosphonate	C01-A016
O-(2-Methylpropyl) S-(2-Diethylaminoethyl)methylphosphothioate	C01-A016
O-(2-Methylpropyl) S-(2-Diethylaminoethyl)methylthiophosphonate	C01-A016
O-(2-Methylpropyl) S-[2-(Diethylamino)ethyl] Methylphosphonothiolate	C01-A016
O-(2-Methylpropyl) S-[2-(Diethylamino)ethyl] Methylthiophosphonate	C01-A016
O-(2-Methylpropyl) S-2-Diethylaminoethyl Methylphosphonothiolate	C01-A016
O-(2-Methylpropyl) S-2-Diethylaminoethyl Methylthiophosphonate	C01-A016
O-(4-Bromo-2,5 Dichlorophenyl) O,O-Diethylphosphorothionate	C11-A025
O-(4-Bromo-2,5-dichlorophenyl) O,O-Diethyl Monothiophosphate	C11-A025
O-(4-Bromo-2,5-dichlorophenyl) O,O-Diethyl Thiophosphate	C11-A025
O-(4-Nitrophenyl) O-Ethyl Phenyl Thiophosphonate	C11-A064
O,2-Dichlorovinyl Phosphate	C11-A055
O,O,O,O-Tetraaethyl-diphosphat, Bis(O,O-diaethylphosphorsaeure-anhydrid)	C11-A167
O,O,O,O-Tetraaethyl-dithionopyrophosphat	C11-A161
O,O,O,O-Tetraethyl Dithiodiphosphate	C11-A161
O,O,O,O-Tetraethyl Dithiopyrophosphate	C11-A161
O,O,O,O-Tetraethyl S,S'-Methylenebis(dithiophosphate)	C11-A065
O,O,O,O-Tetraethyl-difosfaat	C11-A167
O,O,O,O-Tetraethyl-dithio-difosfaat	C11-A161
O,O,O,O-Tetraethyldithiopyrofosfaat	C11-A161
O,O,O,O-Tetraetil-ditio-pirofosfato	C11-A161
O,O,O,O-Tetraetil-pirofosfato	C11-A167
O,O,O',O'-Tetraaethyl-bis(dithiophosphat)	C11-A065
O,O,O',O'-Tetraethyl Pyrophosphate	C11-A167
O,O,O',O'-Tetraethyl S,S'-Methanediyl Bis(dithiophosphate)	C11-A065
O,O,O',O'-Tetraethyl S,S'-Methanediyl Bis(phosphorodithioate)	C11-A065
O,O,O',O'-Tetraethyl S,S'-Methylene Bis(dithiophosphate)	C11-A065
O,O,O',O'-Tetraethyl S,S'-Methylene Bisphosphorodithioate	C11-A065
O,O,O',O'-Tetraethyl S,S'-Methylene Di(phosphorodithioate)	C11-A065
O,O,O',O'-Tetraethyl S,S'-Methylene Diphosphorodithioate	C11-A065
O,O,O',O'-Tetraethyl S,S'-methylenebis(phosphorodithioate)	C11-A065
O,O,O',O'-Tetraethyl S,S'-methylenebisphosphordithioate	C11-A065
O,O,O',O'-Tetraethyl-S,S'-methylene Di(phosphorodithioate)	C11-A065
O,O,O',O'-Tetraethyl-S,S'-methylenebisphosphorodithioate	C11-A065
O,O,O-Tetraethyl-difosfaat	C11-A167
O,O,O-Tetraetil-pirofosfato	C11-A167

O,O'-Diethyl Methylphosphonite	C01-C064
O,O'-Diethyl S-(beta-Diethylamino)ethyl Phosphorothiolate	C01-A014
O,O'-Diethyl S-(β-Diethylamino)ethyl Phosphorothiolate	C01-A014
O,O'-Diethyl S-2-Diethylaminoethyl Phosphorothiolate	C01-A014
O,O'-Diethylmethyl Phosphonolate	C01-C089
O,O-Diaethyl-O-(2-isopropyl-4-methyl)-6-pyrimidyl-thionophosphat	C11-A051
O,O-Diaethyl-O-(2-isopropyl-4-methyl-pyrimidin-6-yl)-monothiophosphat	C11-A051
O,O-Diaethyl-O-(2-isopropyl-4-methyl-pyrinidin-6-yl)-monothiophosphat	C11-A051
O,O-Diaethyl-O-(4-nitro-phenyl)-monothiophosphat	C11-A133
O,O-Diaethyl-O-1-(4,5-dichlorphenyl)-2-chlor-vinyl-phosphat	C11-A037
O,O-Diaethyl-S-((4-chlor-phenyl-thio)methyl)dithiophosphat	C11-A036
O,O-Diaethyl-S-(2-aethylthio-aethyl)-dithiophosphat	C11-A062
O,O-Diaethyl-S-(3-thia-pentyl)-dithiophosphat	C11-A062
O,O-Diaethyl-S-(aethylthio-methyl)-dithiophosphat	C11-A138
O,O-Diethyl 2-Ethylmercaptoethyl Thiophosphate	C11-A050
O,O-Diethyl 2-Ethylthioethyl Phosphorodithioate	C11-A062
O,O-Diethyl 2-Isopropyl-4-methylpyrimidyl-6-thiophosphate	C11-A051
O,O-Diethyl 2-Isopropyl-6-methyl-4-pyrimidinylphosphorothioate	C11-A051
O,O-Diethyl Dithiophosphate	C01-C073
O,O-Diethyl Dithiophosphoric Acid	C01-C073
O,O-Diethyl Dithiophosphoric Acid p-Chlorophenylthiomethyl Ester	C11-A036
O,O-Diethyl Ethylthiomethyl Phosphorodithioate	C11-A138
O,O-Diethyl Hydrogen Phosphate	C01-D173
O,O-Diethyl Hydrogen Phosphorodithioate	C01-C073
O,O-Diethyl Hydrogen Phosphorothioate	C01-C074
O,O-Diethyl Methylphosphonate	C01-C089
O,O-Diethyl Methylphosphonite	C01-C
O,O-Diethyl N,N-dimethylphosphoramidate	C01-C
O,O-Diethyl O-(2-Chloro-1-(2',4'-dichlorophenyl)vinyl) Phosphate	C11-A037
O,O-Diethyl O-(2-Isopropyl-4-methyl-6-pyrimidinyl) Phosphorothioate	C11-A051
O,O-Diethyl O-(2-Isopropyl-4-methyl-6-pyrimidinyl) Thiophosphoric Acid	C11-A051
O,O-Diethyl O-(2-Isopropyl-4-methyl-6-pyrimidyl) Phosphorothioate	C11-A051
O,O-Diethyl O-(2-Isopropyl-4-methyl-6-pyrimidyl) Thionophosphate	C11-A051
O,O-Diethyl O-(2-Isopropyl-6-methyl-4-primidinyl)phosphorothioate	C11-A051
O,O-Diethyl O-(2-Isopropyl-6-methyl-4-pyrimidinyl) Phosphorothioate	C11-A051
O,O-Diethyl O-(2-Isopropyl-6-methyl-4-pyrimidinyl) Thiophosphate	C11-A051
O,O-Diethyl O-(2-Isopropyl-6-methylpyrimidin-4-yl) Thiophosphate	C11-A051
O,O-Diethyl O-(4-Nitrophenyl) Phosphorothioate	C11-A133
O,O-Diethyl O-(4-Nitrophenyl) Thiophosphate	C11-A133
O,O-Diethyl O-(6-Methyl-2-(1-methylethyl)-4-pyrimidinyl) Phosophorothioate	C11-A051
O,O-Diethyl O(and S)-2-(ethylthio)ethyl Phosphorothioate Mixture	C11-A050
O,O-Diethyl O-(para-Nitrophenyl) Phosphorothioate	C11-A133
O,O-Diethyl O-(p-Nitrophenyl) Phosphorothioate	C11-A133
O,O-Diethyl O-(p-Nitrophenyl) Thionophosphate	C11-A133
O,O-Diethyl O-(p-Nitrophenyl) Thiophosphate	C11-A133
O,O-Diethyl O-[1-(2,4-Dichlorophenyl)-2-chlorovinyl] Phosphate	C11-A037
O,O-Diethyl O-[2-(Ethylthio)ethyl]phosphorothiate	C11-A050
O,O-Diethyl O-2-Isopropyl-6-methylpyrimidin-4-yl Phosphorothioate	C11-A051
O,O-Diethyl O-6-Methyl-2-isopropyl-4-pyrimidinyl Phosphorothioate	C11-A051

(*Continued*)

O,O-Diethyl p-Chlorophenylmercaptomethyl Dithiophosphate	C11-A036
O,O-Diethyl Phosphonate	C01-C087
O,O-Diethyl Phosphorodithioate	C01-C073
O,O-Diethyl Phosphorodithioic Acid	C01-C073
O,O-Diethyl Phosphorothioate	C01-C074
O,O-Diethyl S-(((1,1-Dimethylethyl)thio)methyl)phoshorodithioate	C11-A163
O,O-Diethyl S-(((4-Chlorophenyl)thio)methyl) Dithiophosphate	C11-A036
O,O-Diethyl S-(((p-Chlorophenyl)thio)methyl) Dithiophosphate	C11-A036
O,O-Diethyl S-(2-Diethylamino)ethyl Phosphorothioate Hydrogen Oxalate	C01-A014
O,O-Diethyl S-(2-Diethylaminoethyl)thiophosphate	C01-A014
O,O-Diethyl S-(2-Ethylmercaptoethyl) Dithiophosphate	C11-A062
O,O-Diethyl S-(2-Ethylthioethyl) Phosphorodithioate	C11-A062
O,O-Diethyl S-(2-Ethylthioethyl) Thiothionophosphate	C11-A062
O,O-Diethyl S-(Ethylthio)methyl Phosphorodithioate	C11-A138
O,O-Diethyl S-(Ethylthio)methyl Phosphorodithioic Acid	C11-A138
O,O-Diethyl S-(para-Chlorophenylthio)methyl Phosphorodithioate	C11-A036
O,O-Diethyl S-(p-Chlorophenylthio)methyl Phosphorodithioate	C11-A036
O,O-Diethyl S-(t-Butylthio)methyl Phosphorodithioate	C11-A163
O,O-Diethyl S-(tert-Butylthio)methyl Phosphorodithioate	C11-A163
O,O-Diethyl S-[(Ethylsulphanyl)methyl] Dithiophosphoric Acid	C11-A138
O,O-Diethyl S-[2-(Ethylsulfanyl)ethyl] Dithiophosphate	C11-A062
O,O-Diethyl S-[2-(Ethylthio)ethyl] Dithiophosphate	C11-A062
O,O-Diethyl S-2-(Ethylthio)ethyl Phosphorodithioate	C11-A062
O,O-Diethyl S-2-(Ethylthio)-ethyl Phosphorodithioate	C11-A062
O,O-Diethyl S-2-Diethylaminoethyl Phosphorothioate	C01-A014
O,O-Diethyl S-2-Diethylaminoethyl Phosphorothiolate	C01-A014
O,O-Diethyl S-Diethylaminoethyl Phosphorothiolate	C01-A014
O,O-Diethyl S-p-Chlorophenylthiomethyl Dithiophosphate	C11-A036
O,O-Diethyldithiophosphate	C01-C073
O,O-Di-ethylethyl thiomethyldithiofosfaat	C11-A138
O,O-Diethyl-O-(2-isopropyl-4-methyl-6-pyrimidinyl)-phosphorothioate	C11-A051
O,O-Diethyl-O-(2-isopropyl-4-methyl-6-pyrimidyl)phosphorothioate	C11-A051
O,O-Diethyl-O-(2-isopropyl-4-methyl-pyrimidin-6-yl)-monothiofosfaat	C11-A051
O,O-Diethyl-O-(2-isopropyl-4-methylpyrimidyl)thiophosphate	C11-A051
O,O-Diethyl-O-(4-broom-2,5-dichloor-fenyl)-monothiofosfaat	C11-A025
O,O-Diethyl-O-(4-nitro-fenil)monothiofosfaat	C11-A133
O,O-Diethyl-O-(4-nitro-fenil)-monothiofosfaat	C11-A133
O,O-Diethyl-O-(4-nitrofenyl)-thiofosfát	C11-A133
O,O-Diethyl-O-(4-nitrophenyl)-thiophosphorsäureester	C11-A133
O,O-Diethyl-O-(6-methyl-2-(1-methylethyl)-4-pyrimidinyl)phosophorothioate	C11-A051
O,O-Diethyl-O-(p-nitrophenyl)thionophosphate	C11-A133
O,O-Diethyl-O-(p-nitrophenyl)-thiophosphorsäureester	C11-A133
O,O-Diethyl-O-p-nitrofenylester Kyseliny Thiofosforecne	C11-A133
O,O-Diethyl-O-p-nitrophenylthiophosphate	C11-A133
O,O-Diethylphosphorodithioate	C01-C073
O,O-Diethyl-S-(((1,1-Dimethylethyl)thio)methyl)phosphorodithoic Acid	C11-A163
O,O-Diethyl-S-((4-chloor-fenyl-thio)-methyl)-dithiofosfaat	C11-A036
O,O-Diethyl-S-(2-ethylthio-ethyl)-dithiofosfaat	C11-A062
O,O-Diethyl-S-(ethylthio-methyl)-dithiofosfaat	C11-A138
O,O-Diethyl-S-(β-Diethylamino)ethyl Phosphorothiolate	C01-A014

O,O-Diethyl-S-[(ethylthio)methyl]fosfordithioát	C11-A138
O,O-Diethyl-S-ethylmercaptoethyl Dithiophosphate	C11-A062
O,O-Diethyl-S-hydrogen Phosphorodithioate	C01-C073
O,O-Diethyl-S-p-chlorfenylthiomethylester Kyseliny Dithiofosforecne	C11-A036
O,O-Dietil-O-(2-isopropil-4-metil-pirimidin-6-il)-monotiofosfato	C11-A051
O,O-Dietil-O-(2-isopropil-4-metil-pirimidin-il)-monotiofosato	C11-A051
O,O-Dietil-O-(4-bromo-2,5 Dicloro-fenil)-monotiofosfato	C11-A025
O,O-Dietil-O-(4-nitro-fenil)-monotiofosfato	C11-A133
O,O-Dietil-O-4-nitro-feniltiofosfato	C11-A133
O,O-Dietil-S-((4-cloro-fenil-tio)-metile)-ditiofosfato	C11-A036
O,O-Dietil-S-(2-etiltio-etil)-ditiofosfato	C11-A062
O,O-Dietil-S-(etiltio-metil)-ditiofosfato	C11-A138
O,O-Dietyl-O-(4-nitrofenyl)tiofosfat	C11-A133
O,O-Dietyl-O-p-nitrofenyltiofosfat	C11-A133
O,O-Diisopropyl Methylphosphonate	C01-C057
O,O-Dimethyl 1-Carbomethoxy-1-propen-2-yl Phosphate	C11-A123
O,O-Dimethyl 2,2-Dichlorovinyl Phosphate	C11-A055
O,O-Dimethyl Cis-1-methyl-2-methylcarbamoylvinylphosphate	C11-A125
O,O-Dimethyl Dichlorovinyl Phosphate	C11-A055
O,O-Dimethyl Methylphosphonate	C01-C059
O,O-Dimethyl O-(1-Methyl-2-carboxyvinyl) Phosphate	C11-A123
O,O-Dimethyl O-(N,N-Dimethylcarbamoyl-1-methylvinyl) Phosphate	C11-A056
O,O-Dimethyl O-(para-Nitrophenyl) Phosphorothioate	C11-A120
O,O-Dimethyl O-(para-Nitrophenyl) Thiophosphate	C11-A120
O,O-Dimethyl O-(p-Nitrophenyl) Phosphorothioate	C11-A120
O,O-Dimethyl O-(p-Nitrophenyl) Thionophosphate	C11-A120
O,O-Dimethyl O-(p-Nitrophenyl) Thiophosphate	C11-A120
O,O-Dimethyl O-2,2-Dichlorovinyl Phosphate	C11-A055
O,O-Dimethyl O-4-Nitrophenyl Phosphorothioate	C11-A120
O,O-Dimethyl Phosphonate	C01-C085
O,O-Dimethyl Phosphorodithioate S-Ester with 4-(Mercaptomethyl)-2-methoxy-1,3,4-thiadizaolin-5-one	C11-A105
O,O-Dimethyl Phosphorothioate S-Ester with 2-Mercapto-N-methylacetamide	C11-A131
O,O-Dimethyl S-((Methylcarbamoyl)methyl)phosphorothioate	C11-A131
O,O-Dimethyl S-(2-(Methylamino)-2-oxoethyl) Phosphorothioate	C11-A131
O,O-Dimethyl S-(3,4-Dihydro-4-keto-1,2,3-benzotriazinyl-3-methyl) Dithiophosphate	C11-A013
O,O-Dimethyl S-(3,4-Dihydro-4-oxo-1,2,3-benzotriazin-3-yl-methyl) Dithiophosphate	C11-A013
O,O-Dimethyl S-(4-Oxo-1,2,3-benzotriazino(3)-methyl) Thiothionophosphate	C11-A013
O,O-Dimethyl S-(4-Oxo-3H-1,2,3-benzotriazine-3-methyl)phosphorodithioate	C11-A013
O,O-Dimethyl S-(4-Oxobenzotriazino-3-methyl)phosphorodithioate	C11-A013
O,O-Dimethyl S-(5-Methoxy-1,3,4-thiadiazolinyl-3-methyl) Dithiophosphate	C11-A105
O,O-Dimethyl S-(N-Methylcarbamoylmethyl) Phosphorothiolate	C11-A131
O,O-Dimethyl S-(N-Methylcarbamoylmethyl) Thiophosphate	C11-A131
O,O-Dimethyl S-[(5-Methoxy-2-oxo-1,3,4-thiadiazol-3(2 H)-yl)methyl]phosphorodithioate	C11-A105
O,O-Dimethyl S-[(Methylcarbamoyl)methyl] Phosphorothioate	C11-A131
O,O-dimethyl S-[2-(Methylamino)-2-oxoethyl] Phosphorothioate	C11-A131
O,O-Dimethyl S-[2-(Methylamino)-2-oxoethyl] Thiophosphate	C11-A131
O,O-Dimethyl S-[2-Methoxy-1,3,4-thiadiazol-5(4 H)-on-4-ylmethyl] Phosphorodithioate	C11-A105
O,O-Dimethyl S-[4-Oxo-1,2,3-benzotriazine-3(4 H)-ylmethyl] Phosphorodithioate	C11-A013
O,O-Dimethyl S-4-Oxo-1,2,3-benzotriazin-3(4 H)-ylmethyl Phosphorodithioate	C11-A013

(*Continued*)

O,O-Dimethyl-O-(1,4-dimethyl-3-oxo-4-aza-pent-1-enyl)fosfaat	C11-A056
O,O-Dimethyl-O-(1,4-dimethyl-3-oxo-4-aza-pent-1-enyl)phosphate	C11-A056
O,O-Dimethyl-O-(1-methyl-2-N,N-dimethyl-carbamoyl)-vinyl-phosphat	C11-A056
O,O-Dimethyl-O-(1-methyl-2-N-methyl-carbamoyl)-vinyl-phosphat	C11-A125
O,O-Dimethyl-O-(2-carbomethoxy-1-methylvinyl) Phosphate	C11-A123
O,O-Dimethyl-O-(2-dimethyl-carbamoyl-1-methyl-vinyl)phosphat	C11-A056
O,O-Dimethyl-O-(2-dimethyl-carbamoyl-1-methyl-vinyl)phosphate	C11-A056
O,O-Dimethyl-O-(2-N-methylcarbamoyl-1-methyl)vinylphosphat	C11-A125
O,O-Dimethyl-O-(2-N-methylcarbamoyl-1-methyl-vinyl)-fosfaat	C11-A125
O,O-Dimethyl-O-2-methoxycarbonyl-1-methyl-vinyl-phosphat	C11-A123
O,O-Dimethylphosphorodithioate S-Ester with 3-(Mercaptomethyl)-1,2,3-benzotriazin-4-(3 H)-one	C11-A013
O,O-Dimethylphosphorodithioate S-Ester with 4-(Mercaptomethyl)-2-methoxy-Δ2-1,3,4-thiadiazolin-5-one	C11-A105
O,O-Dimethyl-S-((2-methoxy-1,3,4(4 H)-thiodiazol-5-on-4-yl)-methyl)-dithiofosfaat	C11-A105
O,O-Dimethyl-S-((2-methoxy-1,3,4(4 H)thiodiazol-5-on-4-yl)-methyl)-dithiofosfaat	C11-A105
O,O-Dimethyl-S-((4-oxo-3H-1,2,3-benzotriazin-3-yl)-methyl)-dithiofosfaat	C11-A013
O,O-Dimethyl-S-((4-oxo-3H-1,2,3-benzotriazin-3-yl)-methyl)-dithiophosphat	C11-A013
O,O-Dimethyl-S-((N-methyl-carbamoyl)-methyl)-monothiofosfaat	C11-A131
O,O-Dimethyl-S-(1,2,3-benzotriazinyl-4-keto)methyl Phosphorodithioate	C11-A013
O,O-Dimethyl-S-(2-methoxy-1,3,4(4 H)-thiadiazol-5-on-4-yl)methyldithiophosphat	C11-A105
O,O-Dimethyl-S-(2-methoxy-1,3,4-thiadiazol-5(4 H)-onyl-(4)-methyl) Dithiophosphat	C11-A105
O,O-Dimethyl-S-(2-methoxy-1,3,4-thiadiazol-5-on-4-yl)-methyl-dithiophosphat	C11-A105
O,O-Dimethyl-S-(2-oxo-3-azabutyl)-monothiophosphate	C11-A131
O,O-Dimethyl-S-(4-oxobenzotriazin-3-methyl)-dithiophosphat	C11-A013
O,O-Dimethyl-S-(benzaziminomethyl) Dithiophosphate	C11-A013
O,O-Dimethyl-S-(N-methyl-carbamoyl)-methyl-monothiophosphate	C11-A131
O,O-Dimethyl-S-(N-methylcarbamoyl)methylthiophosphat	C11-A131
O,O-Dimethyl-S-(N-methylcarbamoylmethyl)phosphorothioate	C11-A131
O,O-Dimethyl-S-(N-methyl-carbamoyl-methyl)-thiolphosphate	C11-A131
O,O-Dimethyl-S-4-oxo-1,2,3-benzotriazin-3(4 H)-ylmethyl phosphorodithioate	C11-A013
O,O-Dimethyl-S-methyl-carbamoylmethylthiofosfaat	C11-A131
O,O-Dimetil-O-(1,4-dimetil-3-oxo-4-aza-pent-1-enil)-fosfato	C11-A056
O,O-Dimetil-O-(2-N-metilcarbamoil-1-metil-vinil)-fosfato	C11-A125
O,O-Dimetil-S-((2-metossi-1,3,4-(4 H)-tiadiazol-5-on-4-il)-metil)-ditiofosfato	C11-A105
O,O-Dimetil-S-((4-oxo-3H-1,2,3-benzotriazin-3-il)-metil)-ditiofosfato	C11-A013
O,O-Dimetil-S-(N-metil-carbamoil)-metil-monotiofosfato	C11-A131
O,O-Dwuetylo-O-1-(2,4-dwuchlorofenylo)-2-chlorowinylofosforan	C11-A037
O,O-Dwumetylo-O-dwuchlorowinylofosforan	C11-A055
O,O-Ethyl S-2(ethylthio)ethyl Phosphorodithioate	C11-A062
O,O-TEPP	C11-A167
O,S-Diethyl Methyl Phosphonothiolate	C01-D169
O,S-Diethyl Methylthiophosphonate	C01-D169
O,S-Dimethyl Amidothiophosphate	C11-A103
O,S-Dimethyl Ester of Amidothiophosphoric Acid	C11-A103
O,S-Dimethyl Phosphoramidothioate	C11-A103
O,S-Dimethyl Phosphoramidothiolate	C11-A103
O,S-Dimethyl Phosphoroamidothioate	C11-A103
O,S-Dimethyl Thiophosphoramide	C11-A103
O,S-Dimethylamidothiophosphat	C11-A103
O,S-Dimetil Fosforamidotiodato	C11-A103

O1	C03-A018
O-1-Methylethyl Ethylphosphonofluoridate	C01-A004
O-1-Methylethyl Ethylphosphonofluoridoate	C01-A004
O-2,2-Dimethylbut-3-yl Methylphosphonofluoridate	C01-A003
O-2-Chloor-1-(2,4-dichloor-fenyl)-vinyl-O,O-diethylfosfaat	C11-A037
O-2-Chlor-1-(2,4-dichlor-phenyl)-vinyl-O,O-diaethylphosphat	C11-A037
O-2-Cloro-1-(2,4-dicloro-fenil)-vinil-O,O-dietilfosfato	C11-A037
O-2-Diisopropylaminoethyl)-O'-ethyl Methylphosphonite	C01-C064
O-2-Isopropyl-4-methylpyrimidyl-O,O-diethyl Phosphorothioate	C11-A051
O-2-Methylcyclohexyl Methylphosphonofluoridate	C01-A008
OA {Sulfur Mustard and Arsine Oil Mixture}	C03-A
O-Aethyl-O-(2,4,5-trichlorphenyl)-aethylthionophosphonat	C11-A075
O-Aethyl-O-(3-methyl-4-methylthiophenyl)-isopropylamido-phosphorsaeureester	C11-A074
O-Aethyl-O-(4-nitro-phenyl)-phenyl-monothiophosphonat	C11-A064
O-Aethyl-S-(2-dimethylaminoaethyl)-methylphosphonothioat	C01-A018
O-Aethyl-S-phenyl-aethyl-dithiophosphonat	C11-A082
o-Aminoanisole	C11-A010
o-Aminophenol Methyl Ether	C11-A010
o-Anisidin	C11-A010
o-Anisidine	C11-A010
o-Anisylamine	C11-A010
OB {Sulfur Mustard and Bis(2-chloroethyl) Ether Mixture}	C03-A001
Octafluoroisobutene	C10-A008
Octafluoroisobutylene	C10-A008
Octafluoro-s-butene	C10-A008
Octafluoro-s-butylene	C10-A008
Octafluoro-sec-butene	C10-A008
Octafluoro-sec-butylene	C10-A008
Octamethyl Pyrophosphoramide	C11-A148
Octamethyl Pyrophosphortetramide	C11-A148
Octamethyl Tetramido Pyrophosphate	C11-A148
Octamethyl-difosforzuur-tetramide	C11-A148
Octamethyldiphosphoramide	C11-A148
Octamethyl-diphosphorsaeure-tetramid	C11-A148
Octamethylene-bis(5-dimethylcarbamoxy-isoquinolinium Bromide)	C02-A015
Octamethylene-bis(5-dimethylcarbamoxy-isoquinolinium Hydrogen Oxalate)	C02-A015
Octamethylene-bis(5-dimethylcarbamoxy-isoquinolinium Hydrogen Sulfate)	C02-A015
Octamethylene-bis(5-dimethylcarbamoxy-isoquinolinium Nitrate)	C02-A015
Octamethylene-bis(5-dimethylcarbamoxy-isoquinolinium Perchlorate)	C02-A015
Octamethylene-bis(5-dimethylcarbamoxy-isoquinolinium Tetraphenylboronate)	C02-A015
Octamethylp	C11-A148
Octamethylpyrophosphoramide	C11-A148
Octamethylpyrophosphoric Acid Amide	C11-A148
Octamethylpyrophosphoric Acid Tetramide	C11-A148
Octamidophos	C11-A148
Octan-1-thiol	C11-A130
Octane Mercaptan	C11-A130
Octane Thiol	C11-A130
Octanthiol	C11-A130

(*Continued*)

Octathiocane	C01-C061
Octel Fluid	C11-A170
Octyl Mercaptan	C11-A130
Octyl Thiol	C11-A130
O-Cyclohexyl Methylphosphonofluoridate	C01-A005
O-Cyclohexyl Methylphosphonofluoridothiate	C01-A007
O-Cyclohexyl S-[2-(Diethylamino)ethyl] Methylphosphonothioate	C01-A021
O-Cyclohexyl S-[2-(Diethylamino)ethyl] Methylphosphonothiolate	C01-A021
O-Cyclohexyl S-2-Diethylaminoethyl Methylphosphonothioate	C01-A021
O-Cyclohexyl S-2-Diethylaminoethyl Methylphosphonothiolate	C01-A021
O-Cyclohexylmethylphosphonofluoridate	C01-A005
O-Cyclopentyl S-(2-Diethylaminoethly) Methylphosphonothiloate	C01-A019
O-Cyclopentyl S-(2-Diethylaminoethly) Methylphosphonothioate	C01-A019
O-Cyclopentyl S-(2-Diethylaminoethyl)methyl Phosphothioate	C01-A019
O-Cyclopentyl S-(2-Diethylaminoethyl)methyl Thiophosphonate	C01-A019
O-Cyclopentyl S-(2-Diethylaminoethyl)methylphosphothioate	C01-A019
O-Cyclopentyl S-(2-Diethylaminoethyl)methylthiophosphonate	C01-A019
O-Cyclopentyl S-(2-Diisopropylaminoethyl) Methylphosphonothioate	C01-A020
O-Cyclopentyl S-[2-(Diethylamino)ethyl] Methylphosphonothiloate	C01-A019
O-Cyclopentyl S-[2-(Diethylamino)ethyl] Methylphosphonothioate	C01-A019
O-Cyclopentyl S-[2-(Diethylamino)ethyl] Methylphosphonothiolate	C01-A019
O-Cyclopentyl S-[2-(Diethylamino)ethyl] Methylthiophosphonate	C01-A019
O-Cyclopentyl S-[2-(Diisopropylamino)ethyl] Methylphosphonothioate	C01-A020
O-Cyclopentyl S-[2-(Diisopropylamino)ethyl] Methylphosphonothiolate	C01-A020
O-Cyclopentyl S-2-Diethylaminoethyl Methylphosphonothioate	C01-A019
O-Cyclopentyl S-2-Diethylaminoethyl Methylphosphonothiolate	C01-A019
O-Cyclopentyl S-2-Diethylaminoethyl Methylthiophosphonate	C01-A019
O-Cyclopentyl S-2-Diisopropylaminoethyl Methylphosphonothiolate	C01-A020
O-Cyclopentyl S-2-Diispropylaminoethyl Methylphosphonothiolate	C01-A020
OD9275000	C11-A001
O-Demeton and S-Demeton	C11-A050
OEL-UP/9	C03-A018
O-Ethyl 2-Diisopropylaminoethyl Methylphosphonite	C01-C064
O-Ethyl Dimethylamidofluorophosphate	C01-A013
O-Ethyl Ethylphosphonofluoridate	C01-A010
O-Ethyl Ethylphosphonofluoridoate	C01-A010
O-Ethyl Hydrogen Methylphosphonothioate	C01-C069
O-Ethyl Hydrogen Methylphosphonothionate	C01-C069
O-Ethyl Methylphosphonofluoridate	C01-A011
O-Ethyl Methylphosphonothioate	C01-C069
O-Ethyl Methylphosphonothioic Acid	C01-C069
O-Ethyl Methylthiophosphonate	C01-C069
O-Ethyl N,N-dimethyl Phosphoramidocyanidate	C01-A001
O-Ethyl O-(2,4,5-Trichlorophenyl) Ethylphosphonothioate	C11-A075
O-Ethyl O-(2,4,5-Trichlorophenyl) Ethylthiophosphonate	C11-A075
O-Ethyl O-(4-Nitrophenyl) Benzenethionophosphonate	C11-A064
O-Ethyl O-(4-Nitrophenyl) Phenylphosphonothioate	C11-A064
O-Ethyl O-(4-Nitrophenyl)benzenethionophosphonate	C11-A064
O-Ethyl O-(4-Nitrophenyl)benzenethiophosphonate	C11-A064
O-Ethyl O-(4-Nitrophenyl)phenylphosphonothioate	C11-A064

O-Ethyl O-(para-Nitrophenyl) Phenylphosphonothioate	C11-A064
O-ethyl O-(p-Nitrophenyl Phenyl)phosphonothioate	C11-A064
O-Ethyl O-(p-Nitrophenyl) Benzenethiophosphonate	C11-A064
O-Ethyl O-(p-Nitrophenyl) Phenylphosphonothioate	C11-A064
O-Ethyl O-(p-Nitrophenyl) Phenylphosphonothiolate	C11-A064
O-Ethyl O-(p-Nitrophenyl) Phenylphosphonothionate	C11-A064
O-Ethyl O-(p-Nitrophenyl) Phenylphosphorothioate	C11-A064
O-Ethyl O-4-Nitrophenyl Phenylphosphonothioate	C11-A064
O-Ethyl O-para-Nitrophenyl Benzenethiophosphonate	C11-A064
O-Ethyl Phenyl (p-Nitrophenyl) Thiophosphonate	C11-A064
O-Ethyl Phenyl p-Nitrophenyl Thiophosphonate	C11-A064
O-Ethyl Phenylphosphonothioic Acid O-(4-Nitrophenyl) Ester	C11-A064
O-Ethyl S-(2-(Diisopropylamino)ethyl)methylphosphonothioate	C01-A017
O-Ethyl S-(2-Diethylaminoethyl) Methylthiophosphonate	C01-A015
O-Ethyl S-(2-Diisopropylamino)ethyl Phosphonothilate	C01-A017
O-Ethyl S-(2-Diisopropylaminoethyl) Methylphosphonothioate	C01-A017
O-Ethyl S-(2-Diisopropylaminoethyl) Methylphosphonothiolate	C01-A017
O-Ethyl S-(2-Diisopropylaminoethyl) Methylthiolphosphonoate	C01-A017
O-Ethyl S-(2-Diisopropylaminoethyl) Methylthiophosphonate	C01-A017
O-Ethyl S-(2-Dimethylaminoethyl) Methylphosphonothioate	C01-A018
O-Ethyl S-(2-Dimethylaminoethyl) Methylphosphonothiolate	C01-A018
O-Ethyl S-(Dimethylaminoethyl) Methylphosphonothioate	C01-A018
O-Ethyl S,S-Bis(1-methylpropyl) Dithiophosphate	C11-A031
O-Ethyl S,S-Bis(1-methylpropyl) Phosphorodithioate	C11-A031
O-Ethyl S,S-Bis(butan-2-yl) Phosphorodithioate	C11-A031
O-Ethyl S-[2 (Diisopropylamino)ethyl]methylphosphonothiolate	C01-A017
O-Ethyl S-[2-(Bis(1-methylethyl)amino)ethyl] Methylphosphonothiolate, Hydrochloride	C01-A017
O-Ethyl S-[2-(Bis-(1-Methylethyl)methyl)ammonium] Ethyl Methylphosphonothiolate Iodide	C01-A017
O-Ethyl S-[2-(Bis(1-methylethyl)methyl)ammonium] Ethyl Methylphosphonothiolate Iodide	C01-A017
O-Ethyl S-[2-(Bis(isopropyl)amino)ethyl] Methylphosphonothiolate, Hydrochloride	C01-A017
O-Ethyl S-[2-(Bis(isopropyl)methyl)ammonium] Ethyl Methylphosphonothiolate Iodide	C01-A017
O-Ethyl S-[2-(Diethylamino)ethyl] Butylphosphonothioate	C01-A022
O-Ethyl S-[2-(Diethylamino)ethyl] Butylphosphonothiolate	C01-A022
O-Ethyl S-[2-(diethylamino)ethyl] Hexylphosphonothioate	C01-A024
O-Ethyl S-[2-(Diethylamino)ethyl] Hexylphosphonothiolate	C01-A024
O-Ethyl S-[2-(Diethylamino)ethyl] Isopropylphosphonothiolate	C01-A025
O-Ethyl S-[2-(Diethylamino)ethyl] Methylphosphonothioate	C01-A015
O-Ethyl S-[2-(Diethylamino)ethyl] Methylphosphonothiolate	C01-A015
O-Ethyl S-[2-(Diethylamino)ethyl] n-Butylphosphonothiolate	C01-A022
O-Ethyl S-[2-(diethylamino)ethyl] n-Hexylphosphonothioate	C01-A024
O-Ethyl S-[2-(diethylamino)ethyl] n-Hexylphosphonothiolate	C01-A024
O-Ethyl S-[2-(Diethylamino)ethyl] n-Propylphosphonothioate	C01-A026
O-Ethyl S-[2-(Diethylamino)ethyl] n-Propylphosphonothiolate	C01-A026
O-Ethyl S-[2-(Diethylamino)ethyl] Propylphosphonothioate	C01-A026
O-Ethyl S-[2-(Diethylamino)ethyl] Propylphosphonothiolate	C01-A026
O-Ethyl S-[2-(Diethylamino)ethyl]isopropyl Phosphonothioate	C01-A025
O-Ethyl S-[2-(Diethylamino)ethyl]isopropyl Phosphonothiolate	C01-A025
O-Ethyl S-[2-(Diisopropylamino)ethyl] Methylphosphonothiolate	C01-A017
O-Ethyl S-[2-(Diisopropylamino)ethyl] Methylphosphonothiolate, Hydrochloride	C01-A017

(*Continued*)

O-Ethyl S-[2-(Diisopropylamino)ethyl]methylphosphonothioate	C01-A017
O-Ethyl S-[2-(Diisopropylamino)ethyl]methylphosphonothiolate	C01-A017
O-Ethyl S-[2-(Diisopropylmethyl)ammonium] Ethyl Methylphosphonothiolate Iodide	C01-A017
O-Ethyl S-[2-(Dimethylamino)ethyl] Ethylphosphonothiolate	C01-A023
O-Ethyl S-[2-(Dimethylamino)ethyl] Methylphosphonothiolate	C01-A018
O-Ethyl S-[2-(Dimethylethylammonium)ethyl] Methylphosphonothiolate Iodide	C01-A018
O-Ethyl S-[2-(Piperidylamino)ethyl] Ethylphosphonothioate	C01-A027
O-Ethyl S-[2-(Piperidylamino)ethyl] Ethylphosphonothiolate	C01-A027
O-Ethyl S-[2-(Trimethylammonium)ethyl] Methylphosphonothiolate Iodide	C01-A018
O-Ethyl S-2 (Diethylmethylammonium)ethyl Methylphosphonothiolate Iodide	C01-A015
O-Ethyl S-2-(Diethylmethylammonium)ethyl Methylphosphonothiolate Iodide	C01-A015
O-Ethyl S-2-(Diisopropylmethylammonium) Ethyl Methylphosphonothiolate Iodide	C01-A017
O-Ethyl S-2-(Dimethylamino)ethyl Methylphosphonothiolate	C01-A018
O-Ethyl S-2-(Dimethylethylammonium)ethyl Methylphosphonothiolate Iodide	C01-A018
O-Ethyl S-2-(Triethylammonium)ethyl Methylphosphonothiolate Iodide	C01-A015
O-Ethyl S-2-(Trimethylammonium)ethyl Ethylphosphonothiolate Iodide	C01-A023
O-Ethyl S-2-(Trimethylammonium)ethyl Methylphosphonothiolate Iodide	C01-A018
O-Ethyl S-2-[(Dimethylamino)ethyl] Methylphosphonothioate	C01-A018
O-Ethyl S-2-[(Dimethylamino)ethyl] Methylphosphonothiolate	C01-A018
O-Ethyl S-2-[Bis-(1-Methylethyl)methylammonium] Ethyl Methylphosphonothiolate Iodide	C01-A017
O-Ethyl S-2-[Bis(1-methylethyl)methylammonium] Ethyl Methylphosphonothiolate Iodide	C01-A017
O-Ethyl S-2-[Bis(isopropyl)methylammonium] Ethyl Methylphosphonothiolate Iodide	C01-A017
O-Ethyl S-2-Diethylaminoethyl Isopropylphosphonothiolate	C01-A025
O-Ethyl S-2-Diethylaminoethyl Methylphosphonothiolate	C01-A015
O-Ethyl S-2-Diethylaminoethyl Propylphosphonothiolate	C01-A026
O-Ethyl S-2-Diisopropylaminoethyl Methyl Phosphonothiolate	C01-A017
O-Ethyl S-2-Diisopropylaminoethyl Methylphosphonothiolate	C01-A017
O-Ethyl S-2-Diisopropylaminoethyl Methylphosphonothiolate, Hydrochloride	C01-A017
O-Ethyl S-2-Dimethylaminoethyl Ethylphosphonothiolate	C01-A023
O-Ethyl S-2-Dimethylaminoethyl Methylphosphonothioate	C01-A018
O-Ethyl S-2-Dimethylaminoethyl Methylphosphonothiolate	C01-A018
O-Ethyl S-Diethylaminoethyl Methylphosphonothiolate	C01-A015
O-Ethyl S-Diisopropylaminoethyl Methylphosphonothioate	C01-A017
O-Ethyl S-Ethyl Methylphosphonothioate	C01-D169
O-Ethyl S-Hydrogen Methylphosphonothioate	C01-C069
O-Ethyl S-Phenyl Ethyldithiophosphonate	C11-A082
O-Ethyl S-Phenyl Ethylphosphonodithioate	C11-A082
O-Ethyl S-Phenyl Ethylphosphonothiolothionate	C11-A082
O-Ethyl S-phenyl ethylphosphonrothiolothionate	C11-A082
O-Ethyl, S-Bis(1-methylpropyl)phosphorodithioate	C11-A031
O-Ethyl,S-2-diisopropylaminoethyl Methylphosphonothiolate	C01-A017
O-Ethyl-d5 S-2-Diisopropylaminoethyl Methylphosphonothiolate	C01-A017
O-Ethylmethylphosphonothioate	C01-C069
O-Ethyl-O-((4-nitro-fenyl)-fenyl)-monothiofosfonaat	C11-A064
O-Ethyl-O-(4-nitrophenyl)phenylphosphonothioate	C11-A064
O-Ethyl-O-p-nitrofenylester Kyseliny Fenylthiofosfonove	C11-A064
O-Ethyl-O-p-nitrophenylphenylphosphonothioate	C11-A064
O-Ethyl-S-(2-(diethylamino)ethyl) Butylphosphonothioate	C01-A022
O-Ethyl-S-(2-(diethylamino)ethyl) Butylphosphonothiolate	C01-A022
O-Ethyl-S-(2-(diethylamino)ethyl) n-Butylphosphonothioate	C01-A022

O-Ethyl-S-(2-(diethylamino)ethyl) n-Butylphosphonothiolate	C01-A022
O-Ethyl-S-(2-(diethylamino)ethyl) n-Hexylphosphonothiolate	C01-A024
O-Ethyl-S-(2-(diethylamino)ethyl) n-Propylphosphonothiolate	C01-A026
O-Ethyl-S-(2-(diethylamino)ethyl) Propylphosphonothiolate	C01-A026
O-Ethyl-S-(2-(diethylamino)ethyl)-n-butyl Phosphonothiolate	C01-A022
O-Ethyl-S-(2-(diethylamino)ethyl)-n-hexyl Phosphonothiolate	C01-A024
O-Ethyl-S-(2-(diethylamino)ethyl)-n-propyl Phosphonothiolate	C01-A026
O-Ethyl-S-(2-(diethylamino)ethyl)-propyl Phosphonothiolate	C01-A026
O-Ethyl-S-(2-(dimethylamino)ethyl) Ethylphosphonothiolate	C01-A023
O-Ethyl-S-(2-diethylaminoethyl) Methyl Phosphonothiolate	C01-A015
O-Ethyl-S-(2-diethylaminoethyl) Methylphosphonothiolate	C01-A015
O-Ethyl-S-(2-diisopropylaminoethyl) Methyl Phosphonothiolate	C01-A017
O-Ethyl-S-(2-diisopropylaminoethyl)methyl Phosphonothiolate	C01-A017
O-Ethyl-S-(2-dimethylaminoethyl)methyl Phosphonothiolate	C01-A018
O-Ethyl-S-(dimethylaminoethyl)-methylphosphonothioate	C01-A018
O-Ethyl-S,S-bis(1-methylpropyl)phosphorodithioate	C11-A031
O-Ethyl-S,S-di-sec-butylphosphorodithioate	C11-A031
O-Ethyl-S-[2-(diethylamino)ethyl] Ethylphosphonothioate	C01-A
O-Ethyl-S-[2-(diethylamino)ethyl] Isopropylphosphonothioate	C01-A025
O-Ethyl-S-[2-(diethylamino)ethyl] Isopropylphosphonothiolate	C01-A025
O-Ethyl-S-[2-(diethylamino)ethyl]isopropyl Phosphonothiolate	C01-A025
O-Ethyl-S-[2-(diethylamino)ethyl]methyl Phosphonothiolate	C01-A015
O-Ethyl-S-[2-(dimethylamino)ethyl]ethyl Phosphonothiolate	C01-A023
O-Ethyl-S-[2-(piperidylamino)ethyl] Ethylphosphonothioate	C01-A027
O-Ethyl-S-[2-(piperidylamino)ethyl] Ethylphosphonothiolate	C01-A027
O-Ethyl-S-[2-(piperidylamino)ethyl]ethyl Phosphonothioate	C01-A027
O-Ethyl-S-[2-(piperidylamino)ethyl]ethyl Phosphonothiolate	C01-A027
O-Ethyl-S-2 (Triethylammonium)ethyl Methylphosphonothiolate Iodide	C01-A015
O-Ethyl-S-2 (Trimethylammonium)ethyl Ethylphosphonothiolate Iodide	C01-A023
O-Ethyl-S-2 (Trimethylammonium)ethyl Methylphosphonothiolate Iodide	C01-A018
O-Ethyl-S-2-(Dimethylamino) Ethyl Methylphosphonothiolate	C01-A018
O-Ethyl-S-2-(dimethylamino) Ethyl Methylphosphonothiolate	C01-A023
O-Ethyl-S-2-diisopropylaminoethylester Kyseliny Methylthiofosfonove	C01-A017
O-Ethyl-S-diisopropylaminoethyl Methylphosphonothiolate	C01-A017
O-Ethyl-S-phenyl Ethylphosphonodithioate	C11-A082
O-Ethyl-S-phenyl Ethylphosphorothioate	C11-A082
O-Etil-O-((4-nitro-fenil)-fenil)-monotiofosfonato	C11-A064
OG 25	C10-A006
OH	C03-A001
OHS83006	C01-A014
O-Hydrogen S-[2-(Bis(1-methylethyl)amino)ethyl] Methylphosphonothioate	C01-D177
O-Hydrogen S-[2-(Bis(1-methylethyl)amino)ethyl] Methylphosphonothiolate	C01-D177
O-Hydrogen S-[2-(Bis(isopropyl)amino)ethyl] Methylphosphonothioate	C01-D177
O-Hydrogen S-[2-(Bis(isopropyl)amino)ethyl] Methylphosphonothiolate	C01-D177
O-Hydrogen S-[2-(Diisopropylamino)ethyl] Methylphosphonothioate	C01-D177
O-Hydrogen S-[2-(Diisopropylamino)ethyl] Methylphosphonothiolate	C01-D177
O-Hydrogen S-2-Dimethylaminoethyl Ethylphosphonothioate	C01-D179
O-Hydrogen S-2-Dimethylaminoethyl Ethylphosphonothiolate	C01-D179
O-Hydrogen S-2-Dimethylaminoethyl Methylphosphonothioate	C01-D178

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O-Hydrogen S-2-Dimethylaminoethyl Methylphosphonothiolate	C01-D178
Oil of Mustard	C11-A007
Oil of Vitriol	C11-A157
Oils, Brassica Alba	C11-A007
Oils, Brassica Nigra	C11-A007
Oils, Glyceridic, Mustard	C11-A007
Oils, Mustard	C11-A007
o-IMPC	C11-A143
O-Isobutyl S-(2-Diethylaminoethyl)methyl Phosphothioate	C01-A016
O-Isobutyl S-(2-Diethylaminoethyl)methyl Thiophosphonate	C01-A016
O-Isobutyl S-(2-Diethylaminoethyl)methylphosphothioate	C01-A016
O-Isobutyl S-(2-Diethylaminoethyl)methylthiophosphonate	C01-A016
O-Isobutyl S-[2-(Diethylamino)ethyl] Methylphosphonothiolate	C01-A016
O-Isobutyl S-[2-(Diethylamino)ethyl] Methylthiophosphonate	C01-A016
O-Isobutyl S-2-Diethylaminoethyl Methylphosphonothiolate	C01-A016
O-Isobutyl S-2-Diethylaminoethyl Methylthiophosphonate	C01-A016
o-Isopropoxyphenyl Methylcarbamate	C11-A143
O-Isopropyl Ethylphosphonofluoridate	C01-A004
O-Isopropyl Ethylphosphonofluoridoate	C01-A004
O-Isopropyl Hydrogen Methylphosphonate	C01-D170
O-Isopropyl Methylfluorophosphonate	C01-A002
O-Isopropyl Methylisopropoxyfluorophosphine Oxide	C01-A002
O-Isopropyl Methylphosphonic Acid	C01-D170
O-Isopropyl Methylphosphonochloridate	C01-C054
O-Isopropyl Methylphosphonofluoridate	C01-A002
O-Isopropyl N,N-Dimethylphosphoramidocyanidate	C01-A009
O-Isopropyl S-[2-(Diethylamino)ethyl] Methylphosphonothioate	C01-A028
O-Isopropyl S-[2-(Diethylamino)ethyl] Methylphosphonothiolate	C01-A028
O-Isopropyl S-2 (Diethylamino) Ethyl Methylphosphonothiolate	C01-A028
O-Isopropyl S-2-Diethylaminoethyl Methylphosphonothiolate	C01-A028
O-Isopropyl-S-[2-(diethylamino)ethyl] Methylphosphonothiolate	C01-A028
O-Isopropyl-S-[2-(diethylamino)ethyl]methyl Phosphonothiolate	C01-A028
OKM {Sulfur Mustard and Dichlorodipropylsulfide Mixture}	C03-A
Oko	C11-A055
Oksamil	C11-A147
Oksonium Tetrafluoridoborat(1-)	C11-A169
Oksonium Tetrafluoroboranuida	C11-A169
Oktamethyl	C11-A148
Oktamidofos	C11-A148
OL	C03-A001
Oleoakarithion	C11-A036
Oleobidrin	C11-A056
Oleodiazinon	C11-A051
Oleofos 20	C11-A133
Oleoparaphene	C11-A133
Oleoparathene	C11-A133
Oleoparathion	C11-A133
Oleovofotox	C11-A120
Oleum	C11-A157
Oleum Bimsstein (German WWII Smoke Filling) {Sulfuric Acid impregnated Pumice}	C11-A157

Oleum Iodisum	C11-A157
Ol-F	C10-A004
O-Lost	C03-A001
OM {Sulfur Mustard and Dichlorodipropylsulfide Mixture}	C03-A
OM3570000	C08-C002
omega,omega'-Dihydroxyethyl Sulfide	C03-C037
Omethoaat	C11-A131
Omethoate	C11-A131
o-Methoxyaniline	C11-A010
o-Methoxyphenylamine	C11-A010
O-Methyl Ethylphosphonofluoridate	C01-A012
O-Methyl Ethylphosphonofluoridoate	C01-A012
O-Methyl Methylphosphonofluoridothioate	C01-A
Ometoat	C11-A131
OMPA	C11-A148
Ompacide	C11-A148
Ompatox	C11-A148
Ompax	C11-A148
O-Mustard	C03-A003
One-and-a-half Yperite	C03-A002
Ontrack WE Herbicide	C11-A134
O-O-Diethyl-O(and S)-2-(ethylthio)ethyl Phosphorothioate Mixture	C11-A050
OPA	C01-C063
O-Pentadeuterioethyl Methylphosphonofluoridate	C01-A011
O-Pinacolyl Methyl-d3-phosphonofluoridate	C01-A003
O-Pinacolyl Methylphosphonochloridate	C01-C055
O-Pinacolyl Methylphosphonofluoridate	C01-A003
Oplossingen	C11-A083
Optimizer	C11-A051
OQO20I6TWH	C01-C058
OR {Sulfur Mustard and Anthracene or Chlorobenzene Mixture}	C03-A001
OR017705	C01-C072
OR237578	C01-C072
Ordoval-1	C01-A002
Ordoval-2	C01-A003
Ortho 9006	C11-A103
Ortho Earwig Bait	C01-C106
Ortho Weevil Bait	C01-C106
ortho-Aminoanisole	C11-A010
ortho-Anisidin	C11-A010
ortho-Anisidine	C11-A010
ortho-Anisylamine	C11-A010
ortho-Isopropoxyphenyl Methylcarbamate	C11-A143
ortho-Methoxyaniline	C11-A010
ortho-Methoxyphenylamine	C11-A010
Orthophos	C11-A133
Orvinylcarbinol	C11-A004
OS 2046	C11-A123
Oslon	C11-A038

(*Continued*)

Osmi Tetroxit	C11-A146
Osmic Acid	C11-A146
Osmijum Tetroksid	C11-A146
Osmium (VIII) Oxide	C11-A146
Osmium (VIII) Tetraoxide	C11-A146
Osmium Oxide	C11-A146
Osmium Tetra Oxide	C11-A146
Osmium Tetroxide	C11-A146
Osmium(VIII) Oxide	C11-A146
Osmium(VIII)tetraoxide	C11-A146
Osmiumsäure	C11-A146
Osmiumtetraoxide	C11-A146
Osmiumtetroxid	C11-A146
Osmose Wood Preserving Compound	C11-A134
Ossicloruro di Carbonio	C10-A003
Ossido di Carbonio	C09-A001
Ossido di Metilene	C11-A083
Ossido di Zolfo (IV)	C11-A154
Ossido Mercurico	C11-A098
Ossido Nitrico	C11-A127
Ossido Solforoso	C11-A154
Ossimetilene	C11-A083
Othrin	C11-A049
Ottometil-pirofosforammide	C11-A148
OV9100000	C11-A096
OV9800000	C11-A073
OW1515000	C11-A100
OW3010000	C11-A060
OW8000000	C11-A099
OW8225000	C11-A097
OW8750000	C11-A098
Oxacyclopropane	C11-A071
Oxalic Acid Dinitrile	C07-A005
Oxalic Nitrile	C07-A005
Oxalonitrile	C07-A005
Oxalyl Cyanide	C07-A005
Oxamimidic Acid, N',N'-Dimethyl-N-((methylcarbamoyl)oxy)-1-methylthio-	C11-A147
Oxamimidic Acid, N',N'-Dimethyl-N-[(methylcarbamoyl)oxy]-1-thio-, Methyl Ester	C11-A147
Oxamyl	C11-A147
Oxane	C11-A071
Oxid de Azot	C11-A128
Oxid de Osmiu (VIII)	C11-A146
Oxid Dusičitý	C11-A128
Oxid Dusnatý	C11-A127
Oxid Osmičelý	C11-A146
Oxid Rtuťnatý	C11-A098
Oxid Siřičitý	C11-A154
Oxid Sírový	C11-A156
Oxide Mercurique Jaune	C11-A098
Oxido Amarillo de Mercurio	C11-A098

Oxido de Nitrogeno (II)	C11-A127
Oxido Nitrico	C11-A127
Oxidoethane	C11-A071
Oxidonitrogen	C11-A127
Oxidosulfidocarbon	C11-A035
Oxima de Fosgeno	C05-A001
Oxine	C11-A038
Oxiraan	C11-A071
Oxirane	C11-A071
Oxirene, Dihydro-	C11-A071
Oxo(thioxo)methane	C11-A035
Oxoazanyl	C11-A127
Oxocadmium	C11-A030
Oxol	C03-C037
Oxollost	C03-A001
Oxomercury	C11-A098
Oxometano	C11-A083
Oxomethan	C11-A083
Oxomethane	C11-A083
Oxomethyl	C11-A083
Oxomethylene	C11-A083
Oxonium Tetrafluoridoborate(1-)	C11-A169
Oxonium Tetrafluoroboranuide	C11-A169
Oxosulfane Dioxide - Sulfuric Acid	C11-A157
Oxosulfane Oxide	C11-A154
Oxybis(2-chloroethane)	C11-A017
Oxybis(chloromethane)	C10-A011
Oxycarbon Sulfide	C11-A035
Oxychlorid Fosforecny	C01-C083
Oxychlorure de Carbone	C10-A003
Oxyde Azotique	C11-A127
Oxyde D'ethylene	C11-A071
Oxyde de Carbone	C09-A001
Oxyde de Chlorethyle	C11-A017
Oxyde de Mercure	C11-A098
Oxyde de Soufre	C11-A154
Oxyde Mercurique	C11-A098
Oxyde Nitrique	C11-A127
Oxyde Sulfureux	C11-A154
Oxyfume	C11-A071
Oxygen Mustard	C11-A017
Oxygen Yperite	C03-A003
Oxymethylene	C11-A083
- P -	
(Phenylimino)carbonyl Dichloride	C10-A013
(Propan-2-yl)({[(propan-2-yl)imino]methylidene})amine	C01-C058
p,p'-Diphenylmethan-diisocyanat	C11-A113
p,p'-Diphenylmethane Diisocyanate	C11-A113
P,P-Dichloromethylphosphine Sulfide	C01-C066

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P095	C10-A003
P2	C10-A004
PA0350000	C11-A178
PA4900000	C11-A110
PAC	C11-A133
Pacol	C11-A133
Pallite	C10-A004
p-Aminopyridine	C11-A008
Pamisan	C11-A137
Panaplate	C11-A055
Pancide	C11-A013
Pandar	C11-A125
Pandrinox	C11-A119
Pano-drench	C11-A119
Panogen	C11-A108
Panogen Turf Fungicide	C11-A119
Panomatic	C11-A137
Panthion	C11-A133
para-Aminopyridine	C11-A008
Para-col	C11-A132
para-Dioxane-2,3-diyl Ethyl Phosphorodithioate	C11-A061
para-Dithane	C03-D059
para-Dithiane	C03-D059
para-Dithiin, Tetrahydro-	C03-D059
Paradust	C11-A133
Paraform	C11-A083
Paraformaldehyd	C11-A083
Paraformaldehyde	C11-A083
Paraformaldehydum	C11-A083
Paraformic Aldehyde	C11-A083
Paraforsn	C11-A083
Parakvat	C11-A132
Parakwat	C11-A132
Paramar	C11-A133
Paraphos	C11-A133
Paraquat	C11-A132
Parasan	C11-A137
Parataf	C11-A120
Parathene	C11-A133
Parathion	C11-A133
Parathion Ethyl	C11-A133
Parathion Methyl	C11-A120
Parathion-aethyl	C11-A133
para-Thioxane	C03-D058
Paratião	C11-A133
Paration	C11-A133
Paratox	C11-A120
Paratuf	C11-A120
Parawet	C11-A133
Paris Green	C11-A046

Parrot Green	C11-A046
Parryfos	C11-A125
Parthion	C11-A133
Partron M	C11-A120
Patent Green	C11-A046
Pathclear	C11-A132
Patrole	C11-A103
PB0100000	C10-A007
PB0370000	C10-A014
PB2790000	C11-A104
PB4375000	C11-A118
PB6125000	C11-A081
PB6300000	C10-A006
PCE	C11-A136
PCF	C11-A134
PCM	C10-A014
PCP	C11-A134
PD	C04-A004
PD	C04-A004
PD 5	C11-A123
p-Dioxane-2,3-dithiol, S,S-Diester with O,O-Diethyl Phoshorodithioate	C11-A061
p-Dioxane-2,3-dithiol, S,S-Diester with O,O-Diethyl Phosphorodithioate	C11-A061
p-Dioxane-2,3-diyl Ethyl Phosphorodithioate	C11-A061
p-Dithane	C03-D059
p-Dithiane	C03-D059
p-Dithiin, Tetrahydro-	C03-D059
Peceite	C04-A003
Penchlorol	C11-A134
Penite	C11-A151
Penncap E	C11-A133
Penncap M	C11-A120
Penta	C11-A134
Pentacarbonyl Iron	C09-A002
Pentacarbonyliron	C09-A002
Pentachloorfenol	C11-A134
Pentachlorfenol	C11-A134
Pentachloridophosphorus	C01-C082
Pentachlorofenol	C11-A134
Pentachlorol	C11-A134
Pentachlorophenate	C11-A134
Pentachlorophenol	C11-A134
Pentachlorophosphorane	C01-C082
Pentachlorophosphorus	C01-C082
Pentachloro-λ5-phosphane	C01-C082
Pentachlorphenol	C11-A134
Pentaclorofenol	C11-A134
Pentaclorofenolo	C11-A134
Pentacon	C11-A134
Pentafluoreto de Fósforo	C11-A140

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Pentafluorfosforaan	C11-A140
Pentafluoridofosforus	C11-A140
Pentafluoridophosphorus	C11-A140
Pentafluoro-(pentafluoro-λ6-sulfanyl)-λ6-sulfane	C10-A016
Pentafluorofosforana	C11-A140
Pentafluoro-lambda(5)-phosphane	C11-A140
Pentafluorophosphorane	C11-A140
Pentafluorophosphorus	C11-A140
Pentafluoro-λ5-bromane	C11-A023
Pentafluoro-λ5-chlorane	C11-A039
Pentafluoro-λ5-phosphane	C11-A140
Pentafluorure de Phosphore	C11-A140
Pentafluoruro de Fósforo	C11-A140
Pentahlorofenol	C11-A134
Penta-kil	C11-A134
Pentakis(fluoranyl)-λ5-bromane	C11-A023
Pentakis(fluoranyl)-λ5-phosphane	C11-A140
Pentaklorfenol	C11-A134
Pentamethyleenamine	C11-A141
Pentamethylenamin	C11-A141
Pentamethyleneamine	C11-A141
Pentamethyleneimine	C11-A141
Pentamethylenimine	C11-A141
Pentametilenamin	C11-A141
Pentametileneamina	C11-A141
Pentane, 1,5-Bis((2-chloroethyl)thio)-	C03-A013
Pentanol	C11-A134
Pentasulfure de Phosphore	C01-C084
Penwar	C11-A134
Per	C11-A136
Peratox	C11-A134
Perawin	C11-A136
Perc	C11-A136
Perchloorcyclopentadieen	C11-A085
Perchlooretheen	C11-A136
Perchloorethyleen	C11-A136
Perchloorzuur	C11-A135
Perchlor	C11-A136
Perchloraethylen	C11-A136
Perchlorate D'hydrogène	C11-A135
Perchlorcyclopentadien	C11-A085
Perchlorethen	C11-A136
Perchlorethylen	C11-A136
Perchlorethylene	C11-A136
Perchloric Acid	C11-A135
Perchloride of Mercury	C11-A096
Perchlorinemethylmercaptan	C10-A014
Perchlormethylmercaptan	C10-A014
Perchlormethylmerkaptan	C10-A014
Perchloro(methyl Mercaptan)	C10-A014

Perchloro-1,3-cyclopentadiene	C11-A085
Perchlorocyclopenta-1,3-diene	C11-A085
Perchlorocyclopentadiene	C11-A085
Perchloroethene	C11-A136
Perchloroethylene	C11-A136
Perchloromethanethiol	C10-A014
Perchloromethyl Chloroformate	C10-A004
Perchloromethyl Formate	C10-A004
Perchloromethyl Mercaptan	C10-A014
Perchlorophenol	C11-A134
Perchlorosilane	C11-A166
Perchlorsaeure	C11-A135
Perchlorsäure	C11-A135
Perclene	C11-A136
Percloretileno	C11-A136
Percloroeteno	C11-A136
Percloroetilene	C11-A136
Percloroetileno	C11-A136
Percosolve	C11-A136
Perfluor-2-propanon	C11-A086
Perfluoraceton	C11-A086
Perfluorisobutylene	C10-A008
Perfluoro-2-(trifluoromethyl)propene	C10-A008
Perfluoro-2-methylpropene	C10-A008
Perfluoro-2-propanone	C11-A086
Perfluoroacetone	C11-A086
Perfluoroacetyl Chloride	C11-A176
Perfluoroammonia	C11-A129
Perfluoroamonio	C11-A129
Perfluorogermane	C11-A084
Perfluoroisobutene	C10-A008
Perfluoroisobutylene	C10-A008
Perfluorosilane	C11-A150
Perfluorpropanon	C11-A086
Perfluorvinylchlorid	C11-A177
Perhlorna Kiselina	C11-A135
Perhydropyridine	C11-A141
Perk	C11-A136
Perklone	C11-A136
Perkloratna Kiselina	C11-A135
Perklorethylen	C11-A136
Perkloretylen	C11-A136
Perklorna	C11-A135
Permacide	C11-A134
Permagard	C11-A134
Permasan	C11-A134
Permatox	C11-A134
Permite	C11-A134
Perosmic Acid Anhydride	C11-A146

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Perosmic Oxide	C11-A146
Peroxido de Arsenic	C11-A011
PerSec	C11-A136
Perstoff	C10-A004
Pestmaster	C11-A110
Pestox	C11-A148
Pestox 14	C11-A058
Pestox IV	C11-A058
Pestox Plus	C11-A133
Pestox XIV	C11-A058
Pethion	C11-A133
PFIB	C10-A008
Pfiffikus	C04-A004
PFMP	C01-A003
PG {Phosgene (50%) and Chloropicrin (50%) Mixture}	C10-A
Phagase 1	C11-A049
Phaser	C11-A063
PHC	C11-A143
Phenamiphos	C11-A074
Phenmad	C11-A137
Phenol, 2-(1-Methylethoxy)-, 1-(N-Methylcarbamate)	C11-A143
Phenol, 2,3-(Isopropylidenedioxy)-, Methylcarbamate	C11-A014
Phenol, 2,3,4,5,6-Pentachloro-	C11-A134
Phenol, 2,4,5-Trichloro-, O-Ester with O-Ethyl Ethylphosphonothioate	C11-A075
Phenol, 3,5-Dimethyl-4-(methylthio)-, 1-(N-Methylcarbamate)	C11-A106
Phenol, 3,5-Dimethyl-4-(methylthio)-, Methylcarbamate	C11-A106
Phenol, 4-Bromo-2,5-dichloro-, O-Ester with O,O-Diethyl Phosphorothioate	C11-A025
Phenol, O-Ester with O,O-Diethyl Phosphorothioate	C11-A133
Phenol, O-Ester with O-Ethyl Phenyl Phosphonothioate	C11-A064
Phenol, o-Isopropoxy-, Methylcarbamate	C11-A143
Phenol, ortho-Isopropoxy-, Methylcarbamate	C11-A143
Phenol, Pentachloro-	C11-A134
Phenol, Pentacholoro-	C11-A134
Phenol, p-Nitro-, O-Ester with O,O-Diethyl Phosphorothioate	C11-A133
Phenol, p-Nitro-, O-Ester with O-Ethyl Phenyl Phosphonothioate	C11-A064
Phenomercuric Acetate	C11-A137
Phenyl Carbylamine Chloride	C10-A013
Phenyl Dibromoarsine	C04-A005
Phenyl Dichlorarsine	C04-A004
Phenyl Dichloroarsine	C04-A004
Phenyl Isocyanide Dichloride	C10-A013
Phenyl Mercuric Acetate	C11-A137
Phenyl Mercury Acetate	C11-A137
Phenylarsenic Dichloride	C04-A004
Phenylarsine Dibromide	C04-A005
Phenylarsine Dichloride	C04-A004
Phenylarsinedichloride	C04-A004
Phenylarsonous Dibromide	C04-A005
Phenylarsonous Dichloride	C04-A004
Phenylcarbamine	C10-A013

Phenylcarbonimidic Dichloride	C10-A013
Phenylcarbylaminchlorid	C10-A013
Phenylcarbylamine Chloride	C10-A013
Phenyldibromarsine	C04-A005
Phenyldibromoarsine	C04-A005
Phenyldichlorarsine	C04-A004
Phenyldichloro(methyl)silane	C11-A121
Phenyldichloroarsine	C04-A004
Phenylimidocarbonyl Chloride	C10-A013
Phenyliminocarbonyl Dichloride	C10-A013
Phenyliminophosgene	C10-A013
Phenylisocyanide Chloride	C10-A013
Phenylisocyanide Dichloride	C10-A013
Phenylisocyanochloride	C10-A013
Phenylisonitrile Dichloride	C10-A013
Phenylmercury(+2)acetate	C11-A137
Phenylmercury(II) Acetate	C11-A137
Phenylmethyldichlorosilane	C11-A121
Phenylphosphonothioate, O-Ethyl-O-p-nitrophenyl-	C11-A064
Phenylphosphonothioic Acid O-Ethyl O-(4-Nitrophenyl) Ester	C11-A064
Phenylphosphonothioic Acid O-Ethyl O-para-Nitrophenyl Ester	C11-A064
Phenylphosphonothioic Acid O-Ethyl O-p-Nitrophenyl Ester	C11-A064
Phenylphosphonothioic Acid, 2-Ethyl 2-(4-Nitrophenyl) Ester	C11-A064
Phenylphosphonothioic Acid, O-Ethyl O-(4-nitrophenyl) Ester	C11-A064
Phenylquecksilberacetat	C11-A137
Phenylquecksilberacetate	C11-A137
Phenylthiophosphonate de O-Ethyle et O-4-Nitrophenyle	C11-A064
Phix	C11-A137
Phorate	C11-A138
Phosdrin	C11-A123
Phosfene	C11-A123
Phos-Flur	C01-C077
Phosfume {Aluminum Phosphide}	C11-A139
Phosgen	C10-A003
Phosgene	C10-A003
Phosgene Anilide	C10-A013
Phosgene Oxime	C05-A001
Phosgene Oxime and Chlorosulfonic Acid Mixture	C05-A
Phosgenox	C05-A001
Phoskil	C11-A133
Phoskill	C11-A125
Phos-Kill {Aluminum Phosphide}	C11-A139
Phosphamine	C11-A139
Phosphan	C11-A139
Phosphane	C11-A139
Phosphate de Dimethyle et de 2,2-Dichlorovinyle	C11-A055
Phosphate de Dimethyle et de 2-Dimethylcarbamoyl 1-Methyl Vinyle	C11-A056
Phosphate de Dimethyle et de 2-Methoxycarbonyl-1 methylvinyle	C11-A123
Phosphate de Dimethyle et de 2-Methylcarbamoyl 1-Methyl Vinyle	C11-A125

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Phosphate de Diméthyle et de Cis-1-méthyl-2-(N-méthylcarbamoyl)vinyle	C11-A125
Phosphate de O,O-Diethyle et de O-2-Chloro-1-(2,4-dichlorophenyl) Vinyle	C11-A037
Phosphate, 2-2-Dichlorovinyl Dimethyl	C11-A055
Phosphemol	C11-A133
Phosphene	C11-A139
Phosphenol	C11-A133
Phosphine	C11-A139
Phosphine Oxide, Bis(dimethylamino)fluoro-	C11-A058
Phosphine Oxide, Fluoroisopropoxymethyl-	C01-A002
Phosphine Oxide, Fluoromethyl (1,2,2-Trimethylpropoxy)-	C01-A003
Phosphine Oxide, Fluoromethyl(1,2,2-trimethylpropoxy)-	C01-A003
Phosphine Sulfide, Trichloro-	C01-C075
Phosphine, (Difluoro)methyl-	C01-C
Phosphine, Chlorodiethoxy-	C01-C159
Phosphine, Dichloroethyl-	C01-C093
Phosphine, Dichloro-Methylthio-	C01-C066
Phosphine, Trichloro-	C01-C081
Phosphomolybdic Acid	C11-A124
Phosphonamidic Acid, N,N-Diethyl-P-fluoro-, 3-(Dimethylamino)propyl Ester	C01-A034
Phosphonamidic Acid, P-Fluoro-N,N-dimethyl-, 3-(Dimethylamino)propyl Ester	C01-A033
Phosphonic Acid, (1-Methylethyl)-, Diethyl Ester	C01-C091
Phosphonic Acid, Dimethyl Ester	C01-C085
Phosphonic Acid, Ethyl-, Diethyl Ester	C01-C090
Phosphonic Acid, Ethyl-, Dimethyl Ester	C01-C
Phosphonic Acid, Isopropyl-, Diethyl Ester	C01-C091
Phosphonic Acid, Methyl	C01-C060
Phosphonic Acid, Methyl Isopropyl Ester	C01-D170
Phosphonic Acid, Methyl-, Bis(1-methylethyl) Ester	C01-C057
Phosphonic Acid, Methyl-, Cyclohexyl Ester	C01-C072
Phosphonic Acid, Methyl-, Dibutyl Ester	C01-C092
Phosphonic Acid, Methyl-, Diethyl Ester	C01-C089
Phosphonic Acid, Methyl-, Diisopropyl Ester	C01-C057
Phosphonic Acid, Methyl-, Ethyl Ester	C01-D168
Phosphonic Acid, Methyl-, Mono(1-Methylethyl) Ester	C01-D170
Phosphonic Acid, Methyl-, Monocyclohexyl Ester	C01-C072
Phosphonic Acid, Methyl-, Monoethyl Ester	C01-D168
Phosphonic Acid, Methyl, Monoisopropyl Ester	C01-D170
Phosphonic Acid, Methyl-, O,O-Dibutyl Ester	C01-C092
Phosphonic Dichloride, (1-Methylethyl)-	C01-C096
Phosphonic Dichloride, Ethyl-	C01-C094
Phosphonic Dichloride, Isopropyl-	C01-C096
Phosphonic Dichloride, Methyl-	C01-C052
Phosphonic Dichloride, Propyl-	C01-C095
Phosphonic Difluoride, (1-Methylethyl)-	C01-C068
Phosphonic Difluoride, Ethyl-	C01-C
Phosphonic Difluoride, Isopropyl-	C01-C068
Phosphonic Difluoride, Methyl-	C01-C053
Phosphonochloridic Acid, Methyl-, 1,2,2-Trimethylpropyl Ester	C01-C055
Phosphonochloridic Acid, Methyl-, 1-Methylethyl Ester	C01-C054
Phosphonochloridic Acid, Methyl-, Isopropyl Ester	C01-C054

Phosphonochloridic Acid, Methyl-,1,2,2-Trimethylpropyl Ester	C01-C055
Phosphonodifluoridic Acid, Methyl-	C01-C053
Phosphonodithioic Acid, Ethyl-, O-Ethyl S-Phenyl Ester	C11-A082
Phosphonodithioic Acid, Ethyl-, O-Ethyl S-Phenyl Ester, (+-)-	C11-A082
Phosphonodithioic Acid, O,O-Diethyl S-[2-(Ethylthio)ethyl] Ester	C11-A062
Phosphonofluoridic Acid, Ethyl-, 1-Methylethyl Ester	C01-A004
Phosphonofluoridic Acid, Ethyl-, Ethyl Ester	C01-A010
Phosphonofluoridic Acid, Ethyl-, Isopropyl Ester	C01-A004
Phosphonofluoridic Acid, Ethyl-, Methyl Ester	C01-A012
Phosphonofluoridic Acid, Methyl-, 1,2,2-Trimethylpropyl Ester	C01-A003
Phosphonofluoridic Acid, Methyl-, 1-Methylethyl Ester	C01-A002
Phosphonofluoridic Acid, Methyl-, 2,2-Dimethylcyclopentyl Ester	C01-A006
Phosphonofluoridic Acid, Methyl-, 2-Methylcyclohexyl Ester	C01-A008
Phosphonofluoridic Acid, Methyl-, Cyclohexyl Ester	C01-A005
Phosphonofluoridic Acid, Methyl-, Ethyl Ester	C01-A011
Phosphonofluoridic Acid, Methyl-, Iisopropyl Eester	C01-A002
Phosphonofluoridic Acid, Methyl-, Isopropyl Ester	C01-A002
Phosphonofluoridic Acid, Methyl-,1,2,2-Trimethylpropyl Ester	C01-A003
Phosphonofluoridic Acid, Methyl-d3-, 1,2,2-Trimethylpropyl Ester	C01-A003
Phosphonofluoridothioic Acid, Methyl-, O-Cyclohexyl Ester	C01-A007
Phosphonofluridic Acid, Methyl-, Isopropyl Ester	C01-A002
Phosphonothioic Acid, Ethyl-, O-Ethyl O-(2,4,5-Trichlorophenyl) Ester	C11-A075
Phosphonothioic Acid, Ethyl-, O-Ethyl S-2-piperidinoethyl Ester	C01-A027
Phosphonothioic Acid, Ethyl-, O-Ethyl S-2-Piperidinoethyl Ester, Oxalate	C01-A027
Phosphonothioic Acid, Ethyl-, S-[2-(Dimethylamino)ethyl] Ester	C01-D179
Phosphonothioic Acid, Methyl-, O,S-Diethyl Ester	C01-D169
Phosphonothioic Acid, Methyl-, O-Cyclohexyl S-[2-(Diethylamino)ethyl] Ester	C01-A021
Phosphonothioic Acid, Methyl-, O-Cyclopentyl S-[2-(Diethylamino)ethyl] Ester	C01-A019
Phosphonothioic Acid, Methyl-, S-(2-(Bis(1-methylethyl)amino)ethyl) Ester	C01-D177
Phosphonothioic Acid, Methyl-, S-[2-(Dimethylamino)ethyl] Ester	C01-D178
Phosphonothioic Acid, O-Ethyl O-(4-Nitrophenyl) Ester	C11-A064
Phosphonothioic Acid, O-Ethyl O-(p-Nitrophenyl) Ester	C11-A064
Phosphonothioic Acid, O-Ethyl O-(p-Nitrophenyl)Ester	C11-A064
Phosphonothioic Acid, Phenyl-, Ethyl para-Nitrophenyl Ester	C11-A064
Phosphonothioic Acid, Phenyl-, Ethyl p-Nitrophenyl Ester	C11-A064
Phosphonothioic Acid, Phenyl-, O-Ethyl O-(4-Nitrophenyl) Ester	C11-A064
Phosphonothioic Acid, Phenyl-, O-Ethyl O-(para-Nitrophenyl) Ester	C11-A064
Phosphonothioic Acid, Phenyl-, O-Ethyl O-(p-Nitrophenyl) Ester	C11-A064
Phosphonothioic Acid, P-Methyl-, O,S-Diethyl Ester	C01-D169
Phosphonothioic Acid, P-Phenyl-, O-Ethyl O-(4-Nitrophenyl)	C11-A064
Phosphonothioic Dichloride, (1-Methylethyl)-	C01-C070
Phosphonothioic Dichloride, Ethyl-	C01-C163
Phosphonothioic Dichloride, Methyl-	C01-C066
Phosphonous Acid, Methyl-, Diethyl Ester	C01-C
Phosphonous Dichloride, Ethyl-	C01-C093
Phosphonous Difluoride, Ethyl-	C01-C
Phosphonous Difluoride, Methyl-	C01-C
Phosphonyl Trichloride	C01-C083
Phosphor(V)-fluorid	C11-A140

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Phosphoramidic Acid, (1-Methylethyl)-, Ethyl (3-Methyl-4-(methylthio)phenyl) Ester	C11-A074
Phosphoramidic Acid, Dimethyl-, Diethyl Ester	C01-C
Phosphoramidic Acid, Isopropyl-, 4-(Methylthio)-meta-tolyl Ethyl Ester	C11-A074
Phosphoramidic Acid, Isopropyl-, 4-(Methylthio)-m-tolyl Ethyl Ester	C11-A074
Phosphoramidic Acid, Isopropyl-, Ethyl 4-(Methylthio)-meta-tolyl Ester	C11-A074
Phosphoramidic Acid, Isopropyl-, Ethyl 4-(methylthio)-m-tolyl Ester	C11-A074
Phosphoramidic Dichloride, Dimethyl-	C01-C162
Phosphoramidic Difluoride, Diethyl-	C01-C071
Phosphoramidocyanidic Acid, Dimethyl-, 1-Methylethyl Ester	C01-A009
Phosphoramidocyanidic Acid, Dimethyl, Ethyl Ester	C01-A001
Phosphoramidofluoridic Acid, Diethyl-, 2-(Diethylamino)ethyl Ester	C01-A032
Phosphoramidofluoridic Acid, Diethyl-, 2-(Dimethylamino)ethyl Ester	C01-A030
Phosphoramidofluoridic Acid, Dimethyl-, 2-(Diethylamino)ethyl Ester	C01-A031
Phosphoramidofluoridic Acid, Dimethyl-, 2-(Dimethylamino)ethyl Ester	C01-A029
Phosphoramidofluoridic Acid, Dimethyl-, Ethyl Ester	C01-A013
Phosphoramidofluoridic Acid, N-[(1E)-1-(Diethylamino)ethylidene]-, Ethyl Ester	C01-A038
Phosphoramidothioate de O,S-Diméthyle	C11-A103
Phosphoramidothioic Acid, O,S-Dimethyl Ester	C11-A103
Phosphorane, Pentachloro-	C01-C082
Phosphorane, Pentafluoro-	C11-A140
Phosphorated Hydrogen	C11-A139
Phosphore(pentachlorure de)	C01-C082
Phosphore(trichlorure de)	C01-C081
Phosphoretted Hydrogen	C11-A139
Phosphoric Acid 2,2-Dichloroethenyl Dimethyl Ester	C11-A055
Phosphoric Acid 2,2-Dichlorovinyl Dimethyl Ester	C11-A055
Phosphoric Acid 2-Chloro-1-(2,4-dichlorophenyl)ethenyl Diethyl Ester	C11-A037
Phosphoric Acid 3-(Dimethylamino)-1-methyl-3-oxo-1-propenyl Dimethyl Ester	C11-A056
Phosphoric Acid Dimethyl [1-Methyl-3-(methylamino)-3-oxo-1-popenyl] Ester	C11-A125
Phosphoric Acid Monomethyl Ester Dichloride	C01-C161
Phosphoric Acid, (1E)-3-(Dimethylamino)-1-methyl-3-oxo-1-propenyl Dimethyl Ester	C11-A056
Phosphoric Acid, (1-Methoxycarboxypropen-2-yl) Dimethyl Ester	C11-A123
Phosphoric Acid, 3-(Dimethylamino)-1-methyl-3-oxo-1-propenyl Dimethyl Ester, (E)-	C11-A056
Phosphoric Acid, Anhydride with Molybdic Acid	C11-A124
Phosphoric Acid, Diethyl Ester	C01-D173
Phosphoric Acid, Dimethyl 1-Methyl-3-(methylamino)-3-oxo-1-propenyl Ester, (E)-	C11-A125
Phosphoric Acid, Dimethyl 1-Methyl-3-(methylamino)-3-oxo-1-propenyl Ester, (Z)-	C11-A125
Phosphoric Acid, Dimethyl 1-Methyl-N,N-(dimethylamino)-3-oxo-1-propenyl Ester, (E)-	C11-A056
Phosphoric Acid, Dimethyl Ester, Ester with (E)-3-Hydroxy-N-methylcrotonamide	C11-A125
Phosphoric Acid, Dimethyl Ester, Ester with (Z)-3-Hydroxy-N-methylcrotonamide	C11-A125
Phosphoric Acid, Dimethyl Ester, Ester with 3-Hydroxy-N,N-dimethylcrotonamide, (E)-	C11-A056
Phosphoric acid, Dimethyl Ester, Ester with 3-Hydroxy-N-methylcrotonamide, (E)-	C11-A125
Phosphoric acid, Dimethyl Ester, Ester with 3-Hydroxy-N-methylcrotonamide, (Z)-	C11-A125
Phosphoric Acid, Dimethyl Ester, Ester with Dimethyl 3-Hydroxyglutaconate	C11-A018
Phosphoric Acid, Dimethyl Ester, Ester with Methyl 3-Hydroxycrotonate	C11-A123
Phosphoric Acid, Methylfluoro-, Isopropyl Ester	C01-A002
Phosphoric Acid, Tetraethyl Ester	C11-A167
Phosphoric Acid, Triethyl Ester	C01-D175
Phosphoric Acid;Trioxomolybdenum;Hydrate	C11-A124
Phosphoric Chloride	C01-C082

Phosphoric Chloride	C01-C083
Phosphoric Perchloride	C01-C082
Phosphoric Sulfide	C01-C084
Phosphoric Trichloride	C01-C083
Phosphoroamidic Acid, Isopropyl-, 4-(Methylthio)-meta-tolyl Ethyl Ester	C11-A074
Phosphoroamidic Acid, Isopropyl-, 4-(Methylthio)-m-tolyl Ethyl Ester	C11-A074
Phosphorobromidic Acid, Monoethyl Ester, (Chlorofluoromethylene)amino Derivative	C01-C122
Phosphorochloridic Acid, Mono(2-chloro-1-methylpropyl) Ester, O-[(Chlorofluoromethylene)amino] Derivative	C01-C143
Phosphorochloridic Acid, Mono(2-chloroethyl) Ester, O-[(Chlorofluoromethylene)amino] Derivative	C01-C121
Phosphorochloridic Acid, Monoethyl Ester, (1,2,2-Trifluoro-2-nitroethylidene)amino Derivative	C01-C127
Phosphorochloridic Acid, Monoethyl Ester, (Chlorofluoromethylene)amino Derivative	C01-C123
Phosphorochloridic Acid, Monoethyl Ester, (Difluoromethylene)amino Derivative	C01-C126
Phosphorochloridic Acid, Monoisopropyl Ester, (Chlorofluoromethylene)amino Derivative	C01-C129
Phosphorochloridic Acid, Monoisopropyl Ester, (Dichloromethylene)amino Derivative	C01-C133
Phosphorochloridic Acid, Monoisopropyl Ester, (Difluoromethylene)amino Derivative	C01-C137
Phosphorochloridic Acid, Monomethyl Ester, (1,2,2-Trifluoro-2-nitroethylidene)amino Derivative	C01-C120
Phosphorochloridic Acid, Monomethyl Ester, (Chlorofluoromethylene)amino Derivative	C01-C115
Phosphorochloridic Acid, Monomethyl Ester, (Dichloromethylene)amino Derivative	C01-C117
Phosphorochloridic Acid, Monomethyl Ester, (Difluoromethylene)amino Derivative	C01-C118
Phosphorochloridic Acid, Monopropyl Ester, (Chlorofluoromethylene)amino Derivative	C01-C130
Phosphorochloridous Acid Diethyl Ester	C01-C159
Phosphorochloridous Acid, Diethyl Ester	C01-C159
Phosphorochloridousacid,Diethylester	C01-C159
Phosphorodiamidic Fluoride, Tetramethyl-	C11-A058
Phosphorodiamidicfluoride, N,N,N',N'-Tetramethyl-	C11-A058
Phosphorodibromidic Acid, (Chlorofluoromethylene)amino Derivative	C01-C109
Phosphorodichloridic Acid, (1,2,2-Trifluoro-2-nitroethylidene)amino Derivative	C01-C113
Phosphorodichloridic Acid, (Chlorofluoromethylene)Amino Derivative	C01-C111
Phosphorodichloridic Acid, (Dichloromethylene)amino Derivative	C01-C112
Phosphorodichloridic Acid, (Difluoromethylene)amino Derivative	C01-C110
Phosphorodichloridic Acid, Ethyl Ester	C01-C160
Phosphorodichloridic Acid, Methyl Ester	C01-C161
Phosphorodichloridicacid, Methyl Ester	C01-C161
Phosphorodifluoridic Acid Ethyl Ester	C01-C160
Phosphorodifluoridic Acid, Ethyl Ester	C01-C160
Phosphorodifluoridic Acid, Methyl Ester {Novichok Precursor}	C01-C
Phosphorodithioate, O,O-Diethyl S-((Ethylthio)methyl) Ester	C11-A138
Phosphorodithioic Acid O,O'-dimethyl Ester S-Ester with 4-(Mercaptomethyl)-2-methoxy-delta2-1,3,4-thiadiazolin-5-one	C11-A105
Phosphorodithioic Acid O,O'-dimethyl Ester S-Ester with 4-(Mercaptomethyl)-2-methoxy-Δ2-1,3,4-thiadiazolin-5-one	C11-A105
Phosphorodithioic Acid O,O-Diethyl S-[(Ethylthio)methyl] Ester	C11-A138
Phosphorodithioic Acid O,O-Diethyl S-[2-(Ethylthio)ethyl] Ester	C11-A062
Phosphorodithioic Acid O,O-Dimethyl S-[(4-Oxo-1,2,3-benzotriazin-3(4 H)-yl)methyl] Ester	C11-A013
Phosphorodithioic Acid O-Ethyl S,S-Bis(1-methylpropyl) Ester	C11-A031
Phosphorodithioic Acid S-((tert-Butylthio)methyl) O,O-Diethyl Ester	C11-A163
Phosphorodithioic Acid S,S'-1,4-Dioxane-2,3-diyl O,O,O',O'-Tetraethyl Ester	C11-A061
Phosphorodithioic Acid S,S'-para-Dioxane-2,3-diyl O,O,O',O'-Tetraethyl Ester	C11-A061

(*Continued*)

Phosphorodithioic Acid S,S'-p-Dioxane-2,3-diyl O,O,O',O'-Tetraethyl Ester	C11-A061
Phosphorodithioic Acid S-[(t-Butylthio)methyl] O,O-Diethyl Ester	C11-A163
Phosphorodithioic Acid S-[(tert-Butylthio)methyl] O,O-Diethyl Ester	C11-A163
Phosphorodithioic Acid S-[[(4-Chlorophenyl)thio]methyl] O,O-Diethyl Ester	C11-A036
Phosphorodithioic Acid, O,O-Diethyl Ester, S,S-Diester with Methanedithiol	C11-A065
Phosphorodithioic Acid, O,O-Diethyl S-(2-(Ethylthio)ethyl) Ester	C11-A062
Phosphorodithioic Acid, O,O-Diethyl S-[2-(Ethylthio)ethyl] Ester	C11-A062
Phosphorodithioic Acid, O,O-Dietyl Ester, S,S-Diester with Methanedithiol	C11-A065
Phosphorodithioic Acid, O,O-Dimethyl Ester, S-Ester with 3-(Mercaptomethyl)-1,2,3-benzotriazin-4(3 H)-one	C11-A013
Phosphorodithioic Acid, O,O-Dimethyl S-[(4-Oxo-1,2,3-benzotriazin-3(4 H)-yl)methyl] Ester	C11-A013
Phosphorodithioic Acid, S-((5-Methoxy-2-oxo-1,3,4-thiadiazol-3(2 H)-yl)methyl) O,O-Dimethyl Ester	C11-A105
Phosphorodithioic Acid, S,S'-1,4-Dioxane-2,3-diyl O,O,O',O'-Tetraethyl Ester	C11-A061
Phosphorodithioic Acid, S,S'-Methylene O,O,O',O'-Tetraethyl Ester	C11-A065
Phosphorodithioic Acid, S,S'-para-Dioxane-2,3-diyl O,O,O',O'-tetraethyl Ester	C11-A061
Phosphorodithioic Acid, S,S'-p-Dioxane-2,3-diyl O,O,O',O'-Tetraethyl Ester	C11-A061
Phosphorodithioic Acid, S-[[(para-Chlorophenyl)thio]methyl] O,O-Diethyl Ester	C11-A036
Phosphorodithioic Acid, S-[[(p-Chlorophenyl)thio]methyl] O,O-Diethyl Ester	C11-A036
Phosphorodithioic Acid,O,O-Diethyl S-[2-(Ethylthio)ethyl]ester	C11-A062
Phosphorofluoridic Acid, Mono(2-Chloro-1-methylethyl) Ester, O-[(Chlorofluoromethylene)amino] Derivative	C01-A050
Phosphorofluoridic Acid, Mono(2-chloro-1-methylpropyl) ester, O-[(Chlorofluoromethylene)amino] Derivative	C01-A051
Phosphorofluoridic Acid, Mono(2-chloroethyl) Ester, O-[(Chlorofluoromethylene)amino] Derivative	C01-A049
Phosphorofluoridic Acid, Monoethyl Ester, (1,2,2-Trifluoro-2-nitroethylidene)amino Derivative	C01-A048
Phosphorofluoridic Acid, Monoethyl Ester, (Chlorofluoromethylene)amino Derivative	C01-A046
Phosphorofluoridic Acid, Monoethyl Ester, (Dichloromethylene)amino Derivative	C01-A045
Phosphorofluoridic Acid, Monoethyl Ester, (Difluoromethylene)amino Derivative	C01-A047
Phosphorofluoridic Acid, Monomethyl Ester, (Chlorofluoromethylene)amino Derivative	C01-A042
Phosphorofluoridic Acid, Monomethyl Ester, (Dichloromethylene)amino Derivative	C01-A041
Phosphorofluoridic Acid, Monomethyl Ester, (Difluoromethylene)amino Derivative	C01-A043
Phosphorothioate, O,O-Diethyl O-6-(2-Isopropyl-4-methylpyrimidyl)	C11-A051
Phosphorothioate,O-diethyl O-6-(2-Isopropyl-4-methylpyrimidyl)	C11-A051
Phosphorothioic Acid O,O-Diethyl O-(4-nitrophenyl) Ester	C11-A133
Phosphorothioic Acid O,O-Dimethyl O-(4-Nitrophenyl) Ester	C11-A120
Phosphorothioic Acid, O-(4-Bromo-2,5-dichlorophenyl) O,O-Diethyl Ester	C11-A025
Phosphorothioic Acid, O,O-Diethyl 2-Isopropyl-6-methyl-4-pyrimidinyl Ester	C11-A051
Phosphorothioic Acid, O,O-Diethyl O-(2-(Ethylthio)ethyl) Ester, Mixed with O,O-Diethyl S-(2-(Ethylthio)ethyl) Phosphorothioate	C11-A050
Phosphorothioic Acid, O,O-Diethyl O-(6-Methyl-2-(1-methylethyl)-4-pyrimidinyl) Ester	C11-A051
Phosphorothioic Acid, O,O-Diethyl O(and S)-(Ethylthio)ethyl Esters	C11-A050
Phosphorothioic Acid, O,O-Diethyl O-(Isopropylmethylpyrimidinyl) Ester	C11-A051
Phosphorothioic Acid, O,O-Diethyl O-(para-Nitrophenyl) Ester	C11-A133
Phosphorothioic Acid, O,O-Diethyl O-(p-Nitrophenyl) Ester	C11-A133
Phosphorothioic Acid, O,O-Diethyl O-[2-(Ethylthio)ethyl] Ester, Mixture with O,O-Diethyl S-[2-(ethylthio)ethyl] Phosphorothioate	C11-A050
Phosphorothioic Acid, O,O-Diethyl O-[6-methyl-2-(1-methylethyl)-4-pyrimidinyl] Ester	C11-A051
Phosphorothioic Acid, O,O-Dimethyl Ester, S-Ester with 2-Mercapto-N-methylacetamide	C11-A131
Phosphorothioic Acid, O,O-Dimethyl O-(para-Nitrophenyl) Ester	C11-A120

Phosphorothioic Acid, O,O-Dimethyl O-(p-Nitrophenyl) Ester	C11-A120
Phosphorothioic Acid, O,O-Dimethyl S-(2-(Methylamino)-2-oxoethyl) Ester	C11-A131
Phosphorothioic Acid, S-((2-Diethylamino)ethyl) O,O-Diethyl Ester, Oxalate	C01-A014
Phosphorothioic Acid, S-(2-(Diethylamino)ethyl) O,O-Diethyl Ester	C01-A014
Phosphorothioic Acid, S-(2-(Diethylamino)ethyl) O,O-Diethyl Ester, Ethanedioate	C01-A014
Phosphorothioic Acid, S-(2-Diethylaminoethyl) O,O-Diethyl Ester, Citrate	C01-A014
Phosphorothioic Acid, S-[2-(Diethylamino)ethyl] O,O-Diethyl Ester	C01-A014
Phosphorothioic Acid, S-[2-(Diethylamino)ethyl] O,O-Diethyl Ester, Ethanedioate	C01-A014
Phosphorothioic Acid, S-[2-(Diethylamino)Ethyl] O,O-Diethyl Ester, Oxalate	C01-A014
Phosphorothioic Acid,O,O-Diethyl Ester	C01-C074
Phosphorothioic Acid,O-diethyl O-(2-isopropyl-6-methyl-4-pyrimidinyl) Ester	C11-A051
Phosphorothioic Acid,O-diethyl O-(p-Nitrophenyl) Ester	C11-A133
Phosphorothioic Trichloride	C01-C075
Phosphorothionic Trichloride	C01-C075
Phosphorothioyl Trichloride	C01-C075
Phosphorous Acid Diethyl	C01-C087
Phosphorous Acid Trimethyl	C01-C086
Phosphorous Acid, Triethyl Ester	C01-C088
Phosphorous Acid, Triisopropyl Ester	C01-C164
Phosphorous Acid, Trimethyl Ester	C01-C086
Phosphorous Acid, Tris(1-methylethyl) Ester	C01-C164
Phosphorous Chloride	C01-C081
Phosphorous Chloride Oxide	C01-C083
Phosphorous Oxychloride	C01-C083
Phosphorous Pentachloride	C01-C082
Phosphorous Pentasulfide	C01-C084
Phosphorous Sulfochloride	C01-C075
Phosphorous Thiochloride	C01-C075
Phosphorous Trichloride	C01-C081
Phosphorous Trichloride Sulfide	C01-C075
Phosphorousoxychloride	C01-C083
phosphoroustrichloride	C01-C081
Phosphoroxidchlorid	C01-C083
Phosphoroxychlorid	C01-C083
Phosphoroxychloride	C01-C083
Phosphoroxytrichloride	C01-C083
Phosphorpentachlorid	C01-C082
Phosphorpentafluorid	C11-A140
Phosphorsaeure-aethylester-difluorid	C01-C160
Phosphortrichlorid	C01-C081
Phosphortrichloridoxid	C01-C083
Phosphorus (III) Chloride	C01-C081
Phosphorus (V) Chloride Oxide	C01-C083
Phosphorus (V) Sulfide	C01-C084
Phosphorus (V) Trichloride Oxide	C01-C083
Phosphorus Chloride	C01-C081
Phosphorus Chloride	C01-C082
Phosphorus Chloride	C01-C083
Phosphorus Chloride Oxide	C01-C083

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Phosphorus Chloride Sulfide	C01-C075
Phosphorus Fluoride	C11-A140
Phosphorus Hydride	C11-A139
Phosphorus Monohydride	C11-A139
Phosphorus Monoxide Trichloride	C01-C083
Phosphorus Oxide Chloride	C01-C083
Phosphorus Oxide Trichloride	C01-C083
Phosphorus Oxychloride	C01-C083
Phosphorus Oxytrichloride	C01-C083
Phosphorus Pentafluoride	C11-A140
Phosphorus Pentasulfide	C01-C084
Phosphorus Perchloride	C01-C082
Phosphorus Persulfide	C01-C084
Phosphorus Sulfide	C01-C084
Phosphorus Sulfochloride	C01-C075
Phosphorus Thiochloride	C01-C075
Phosphorus Trichloride	C01-C081
Phosphorus Trichloride Oxide	C01-C083
Phosphorus Trichloride Sulfide	C01-C075
Phosphorus Trihydride	C11-A139
Phosphorus Triochloride	C01-C075
Phosphorus(V) Oxide Chloride	C01-C083
Phosphorus(V) Sulfide	C01-C084
Phosphorus(V) Trichloride Oxide	C01-C083
Phosphorusoxychloride	C01-C083
Phosphoruspentachloride	C01-C082
Phosphorustrichloride	C01-C081
Phosphorus-trichloride	C01-C081
Phosphorwasserstoff	C11-A139
Phosphoryl Chloride	C01-C083
Phosphoryl Oxychloride	C01-C083
Phosphoryl Trichloride	C01-C083
Phosphorylchlorid	C01-C083
Phosphostigmine	C11-A133
Phosphotox E	C11-A065
Phosphure D'hydrogène	C11-A139
Phostoxin {Aluminum Phosphide}	C11-A139
Phostoxin A {Aluminum Phosphide}	C11-A139
Phosvit	C11-A055
Photophor {Calcium Phosphide}	C11-A139
Phốtphin	C11-A139
Phytosol	C11-A075
PI	C11-A145
Pieciochlorek Fosforu	C01-C082
Pied Piper Mouse Seed	C11-A159
Piitetrakloridi	C11-A166
Pillardrin	C11-A125
Pillarfuran	C11-A032
Pillargon	C11-A143
Pillaron	C11-A103

Pillarquat	C11-A132
Pillarxone	C11-A132
PIN	C11-A064
Pinacolin	C01-C101
Pinacoline	C01-C101
Pinacolone	C01-C101
Pinacoloxymethylphosphoryl Fluoride	C01-A003
Pinacolyl Alcohol	C01-C102
Pinacolyl Methane Fluorophosphonate	C01-A003
Pinacolyl Methanefluorophosphonate	C01-A003
Pinacolyl Methyl Phosphonofluoridate	C01-A003
Pinacolyl Methyl-d3-phosphonofluoridate	C01-A003
Pinacolyl Methylfluorophosphonate	C01-A003
Pinacolyl Methylphosphonochloridate	C01-C055
Pinacolyl Methylphosphonofluoridate	C01-A003
Pinacolyl Methylphosphonofluoride	C01-A003
Pinacolyloxy Methylphosphoryl Fluoride	C01-A003
Pinacolyloxymethylphosphonyl Fluoride	C01-A003
Pinacolyl-tx Methylphosphonofluoridate	C01-A003
Pinakolin	C01-C101
Piombo Tetraetile	C11-A168
Piombo Tetra-metile	C11-A170
Piperdine	C11-A141
Piperidina	C11-A141
Piperidine	C11-A141
Piperydyna	C11-A141
Pirofos	C11-A161
Pirofosforan Tetraetylu	C11-A167
PKhF	C11-A134
PKHFN	C11-A134
Plandrin	C11-A125
Plantdrin	C11-A125
Plantfume 103	C11-A161
Plomb Tétraéthyle	C11-A168
Plumbane, Tetraethyl-	C11-A168
Plumbane, Tetramethyl-	C11-A170
PM Acetate	C11-A137
PMA	C11-A137
PMAC	C11-A137
PMAL	C11-A137
PMAS	C11-A137
PMDI	C11-A113
PMFP	C01-A003
PMM	C10-A014
p-Nitrophenol O-Ester with O,O-Diethylphosphorothioate	C11-A133
p-Nitrophenol O-Ester with O,O-Diethylphosphorothioic Acid	C11-A133
p-Nitrophenyl Diethyl Thiophosphate	C11-A133
PO-Dimethoate	C11-A131
Pol Nu	C11-A134

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Polsinex 20	C01-C061
Polsinex 33	C01-C061
Polsinex N	C01-C061
Poly(oxymethylene)	C11-A083
Polymer Fume Fever	C10-A008
Polyoxymethylene	C11-A083
Polyoxymethylene Glycol	C11-A083
Potassium Acid Bifluoride	C01-C078
Potassium Acid Fluoride	C01-C078
Potassium Bifluoride	C01-C078
Potassium Cyanide	C07-C008
Potassium Fluoride	C01-C076
Potassium Fluoride Hydrofluoride	C01-C078
Potassium Fluorure	C01-C076
Potassium Hydrogen Difluoride	C01-C078
Potassium Hydrogen Fluoride	C01-C078
Potassium Monofluoride	C01-C076
Potassium Monohydrogen Difluoride	C01-C078
Potassium Phosphide	C11-A139
Potassium Salt of Hydrocyanic Acid	C07-C008
Potassium;cyanide	C07-C008
Powder Green	C11-A046
Powdered Sulfur and Dimethyl Disulfide Mixture	C01-C062
Prentox	C11-A055
Preparation 9/91	C01-A001
Preventol P	C11-A134
Priltox	C11-A134
Prima U	C11-A055
Probel MP 2	C11-A120
Prodaluminol Double	C11-A151
Prodalumnol	C11-A151
Prodan	C01-C106
Product G	C01-A001
Profume	C11-A110
ProFume	C11-A160
Programin	C11-A137
Prop-2-en-1-amine	C11-A005
Prop-2-en-1-ol	C11-A004
Prop-2-en-1-yl Carbonochloridate	C11-A006
Prop-2-enenitrile	C11-A002
Prop-2-enisothiocyanate	C11-A007
Prop-2-enyl Carbonochloridate	C11-A006
Prop-2-enyl Chloroformate	C11-A006
Propaannitril	C11-A142
Propan-2-amine	C01-C100
Propan-2-isocyanate	C11-A094
Propan-2-yl Carbonochloridate	C11-A093
Propan-2-yl Chloroformate	C11-A093
Propan-2-yl Methylphosphonochloridate	C01-C054
Propanal, 2-Amino-	C01-C100

Propanal, 2-Methyl-2-(methylthio)-, O-[(Methylamino)carbonyl]oxime	C11-A003
Propane, 1,2-Dibromo-3-chloro-	C11-A053
Propane, 1,3-Bis[(2-Chloroethyl)thio]-	C03-A014
Propane, 1-Chloro-2,3-dibromo-	C11-A053
Propane, 2-Amino-	C01-C100
Propane, 2-Isocyanato-	C11-A094
Propane, 2-Isocyanato-2-methyl-	C11-A029
Propane, Dibromochloro-	C11-A053
Propane,2-dibromo-3-chloro-	C11-A053
Propanenitrile	C11-A142
Propanenitrile, 2-Hydroxy-2-methyl-	C11-A001
Propanenitrile, 2-Methyl-	C11-A095
Propanephosphonic Dichloride	C01-C095
Propanimidamide, N,N-Dipropyl- {Novichok Precursor}	C01-C
Propanimidoyl Chloride, N-[(Chloroethoxyphosphinyl)oxy]-	C01-C141
Propanimidoyl Chloride, N-[(Chloroethoxyphosphinyl)oxy]-2-methyl-	C01-C147
Propanimidoyl Chloride, N-[(Chloropropoxyphosphinyl)oxy]-	C01-C146
Propanimidoyl Chloride, N-[(Chloropropoxyphosphinyl)oxy]-2-methyl-	C01-C152
Propanimidoyl Chloride, N-[(Dichlorophosphinyl)oxy]-	C01-C124
Propanimidoyl Chloride, N-[(Dichlorophosphinyl)oxy]-2-methyl-	C01-C131
Propanimidoyl Chloride, N-[[Chloro(1-methylethoxy)phosphinyl]oxy]-	C01-C144
Propanimidoyl Chloride, N-[[Chloro(1-methylethoxy)phosphinyl]oxy]-2-methyl-	C01-C151
Propanimidoyl Chloride, N-[[Chloro(2-methylpropoxy)phosphinyl]oxy]-	C01-C149
Propanimidoyl Chloride, N-[[Chloro(2-methylpropoxy)phosphinyl]oxy]-2-methyl-	C01-C154
Propannitril	C11-A142
Propanoic Acid, 2-Methyl-, Nitrile	C11-A095
Propanonitrila	C11-A142
Propansäurenitril	C11-A142
Propellant 11	C11-A081
Propen-1-ol-3	C11-A004
Propene, 1,1,3,3,3-Pentafluoro-2-(trifluoromethyl)-	C10-A008
Propene, 3-Chloro-2-methyl-	C11-A102
Propene, 3-Isothiocyanato-	C11-A007
Propene, Pentafluoro-2-(trifluoromethyl)-	C10-A008
Propenenitrile	C11-A002
Propenenitrile, 2-Methyl	C11-A101
Propenol	C11-A004
Propenyl Alcohol	C11-A004
Propenyl Isothiocyanate	C11-A007
Propila Estero de la Karbonoklorida Acido	C11-A144
Propila Estero de la Kloroformiata Acido	C11-A144
Propila Kloroformiato	C11-A144
Propilenimin	C11-A145
Propilenimina	C11-A145
Propionaldehyde, 2-Methyl-2-(methylthio)-, O-(Methylcarbamoyl)oxime	C11-A003
Propionic Nitrile	C11-A142
Propionitrile	C11-A142
Propionitryl	C11-A142
Propiononitrile	C11-A142

(*Continued*)

Propionsäurenitril	C11-A142
Propogon	C11-A143
Propoksur	C11-A143
Propoksuru	C11-A143
Propotox	C11-A143
Propoxure	C11-A143
Propoxyl-2-methylphosphoryl Fluoride	C01-A002
Propoxylor	C11-A143
Propyl Bis(beta-chloroethyl)amine	C03-A030
Propyl Bis(β-chloroethyl)amine	C03-A030
Propyl Carbonochloridate	C11-A144
Propyl Chlorocarbonate	C11-A144
Propyl Chloroformate	C11-A144
Propylamine Mono	C01-C100
Propylamine, 3-Chloro-N-(2-chloroethyl)-N-methyl-	C03-A026
Propylamine, 3-Chloro-N,N-bis(2-chloroethyl)-	C03-A028
Propylamine, N,N-Bis(2-chloroethyl)-	C03-A030
Propyl-Didi {Propylphosphonic Difluoride (50%) and Propylphosphonic Dichloride (50%) Mixture}	C01-C
Propyleenimine	C11-A145
Propylene Aldehyde	C11-A047
Propylene Fluorophosphite	C01-C157
Propylene Imine	C11-A145
Propylene-1,2-imine	C11-A145
Propyleneimine	C11-A145
Propylenimine	C11-A145
Propylnitrile	C11-A142
Propylphosphonic Dichloride	C01-C095
Propylphosphonic Dichloride Difluoride	C01-C
Propylphosphonyl Dichloride	C01-C095
Propylphosphonyldifluoride (50%) and Propylphosphonyldichloride (50%) Mixture	C01-C
Propyon	C11-A143
Prussic Acid	C07-A001
Prussite	C07-A005
PS	C10-A006
PT	C01-C081
PT	C11-A168
p-Thioxane	C03-D058
Purite	C11-A038
Purogene	C11-A038
Pymadin	C11-A008
Pynacolyl Methylfluorophosphonate	C01-A003
Pyridin-4-amine	C11-A008
Pyridin-4-ylamine	C11-A008
Pyridinamine	C11-A008
Pyridine, 4-Amino	C11-A008
Pyridine-4-ylamine	C11-A008
Pyridinium, 1-[10-[[[3-[[(Dimethylamino)carbonyl]oxy]-2-pyridinyl]methyl]dimethylammonio] decyl]-, Dibromide	C02-A035
Pyridinium, 1-[10-[[[3-[[(Dimethylamino)carbonyl]oxy]-2-pyridinyl]methyl]dimethylammonio] decyl]-4-[(hydroxyimino)methyl]-, Bis[Tetraphenylborate(1-)]	C02-A039

Pyridinium, 1-[10-[[[3-[[(Dimethylamino)carbonyl]oxy]-2-pyridinyl]methyl]dimethylammonio] decyl]-4-[(hydroxyimino)methyl]-, Dibromide	C02-A039
Pyro	C03-A001
Pyro B {Sulfur Mustard and Benzene Mixture}	C03-A001
Pyro M {Sulfur Mustard and Chlorobenzene Mixture}	C03-A001
Pyrodust	C11-A167
Pyrol DMMP	C01-C059
Pyrophosphate de Tetraethyle	C11-A167
Pyrophosphoramide, Octamethyl-	C11-A148
Pyrophosphoric Acid Octamethyltetraamide	C11-A148
Pyrophosphoric Acid Tetraethyl	C11-A167
Pyrophosphoric Acid Tetraethyl Ester	C11-A167
Pyrophosphoric Acid Tetrakis(dimethylamide)	C11-A148
Pyrophosphoric Acid, Dithiono-, Tetraethyl Ester	C11-A161
Pyrophosphoric Acid, Tetraethyldithio-	C11-A161
Pyrophosphorodithioic Acid, O,O,O,O-Tetraethyl Ester	C11-A161
Pyrophosphorodithioic Acid, Tetraethyl Ester	C11-A161
Pyrophosphoryltetrakisdimethylamide	C11-A148
Pyrosulfuric Acid	C11-A157
Pyrosulphuric Acid	C11-A157
Pyrrolidinium, 1,1'-[[1,1'-Biphenyl]-4,4'-diylbis(2-oxo-2,1-ethanediyl)]bis[1-[[3-[[(dimethylamino) carbonyl]oxy]-2-pyridinyl]methyl]-, Dibromide	C02-A026
Pyrrolidinium, 1-[10-[[[3-[[(Dimethylamino)carbonyl]oxy]-2-pyridinyl]methyl]dimethylammonio] decyl]-1-methyl-, Bis[Tetraphenylborate(1-)]	C02-A036
Pyrrolidinium, 1-[10-[[[3-[[(Dimethylamino)carbonyl]oxy]-2-pyridinyl]methyl]dimethylammonio] decyl]-1-methyl-, Dibromide	C02-A036

- Q -

Q	C03-A002
Q27464756	C01-C072
Q2964135	C01-C054
Q3491298	C01-C064
Qazi-ketcham	C11-A071
Q-diol	C03-D046
QL	C01-C064
QMP	C01-C072
QN2	C03-A002
QR6300000	C09-A003
QU5775000	C11-A126
QU5900000	C11-A126
Quecksilber Chlorid	C11-A096
Quecksilber(I)-nitratlosung	C11-A099
Quecksilber(II)-cyanid	C11-A100
Quecksilber(II)-nitrat	C11-A097
Quecksilber(II)-oxid	C11-A098
Quecksilbercarbid	C11-A060
Quecksilbercyanid	C11-A100
Quecksilberoxid	C11-A098
Quecksilberoxyd	C11-A098
Quecksilberpernitrat	C11-A097

(*Continued*)

Quick-Phos {Aluminum Phosphide}	C11-A139
Quicksan	C11-A137
Quik-Fume {Aluminum Phosphide}	C11-A139
Quinophos	C11-A120
QW9800000	C11-A128
QX0525000	C11-A127
QX1925000	C11-A129
- R -	
R8	C11-A119
R 11	C11-A081
R 20	C11-A043
R33	C01-A016
R-35	C01-A002
R43	C04-A002
R43A	C04-A002
R47	C03-A018
R55	C01-A003
R74	C03-A001
R84	C01-A036
R-130	C11-A165
R 611	C11-A115
R 1113	C11-A177
R-1140	C11-A180
R1158	C01-A014
R 1303	C11-A036
R 1582	C11-A013
R5153	C01-A014
R5158	C01-A014
Radosan	C11-A108
Raksa Dinitrate	C11-A097
Raksa(II) Nitrat	C11-A097
Rampart	C11-A032
Rampart	C11-A138
Rapid X	C11-A125
Rasayansulfan	C11-A063
Rat Death Liquid	C11-A151
Ratbane 1080	C11-A152
Rationite {Dimethyl Sulfate (75%) and Chlorosulfonic Acid (25%) or Methyl Chlorosulfonate (25%) Mixture}	C03-A
Ratol {Zinc Phosphide}	C11-A139
Rattengiftkonserve	C11-A171
RB	C11-A133
RB9275000	C11-A063
RB9275100 {α-Form}	C11-A063
RB9875200 {β-Form}	C11-A063
RC-Schwefel Extra	C01-C061
RE 9006	C11-A103
Red Fuming Nitric Acid	C11-A126
Red Mercuric Oxide	C11-A098
Red Mercury	C11-A098

Red Oxide of Mercury	C11-A098
Red Precipitate	C11-A098
Red Star (British WWI Cylinder Gas)	C10-A001
Redskin	C11-A007
Refrigerant 11	C11-A081
Refrigerant R20	C11-A043
Refrigerant-1140	C11-A180
Refrigerent R717	C11-A009
RenNew D	C11-A038
Reoflam DMMP	C01-C059
RetarDEX	C11-A038
RFNA	C11-A126
R-GB	C01-A002
Rhenogran S 80	C01-C061
Rhoden	C11-A143
Rhodex	C11-A077
Rhodia 6200	C01-A014
Rhodiacide	C11-A065
Rhodiasol	C11-A133
Rhodiatox	C11-A133
Rhodiatrox	C11-A133
Rhodocide	C11-A065
Richloronate	C11-A075
Rikkitetrafluoridi	C11-A155
Riogen	C11-A137
RK7	C03-A010
RM 98D	C01-C061
RN1140000	C11-A146
Roach Salt	C01-C077
Röd Rykande Salpetersyra	C11-A126
Rodex	C11-A077
Ro-dex	C11-A159
Rodiatox	C11-A133
Rodocide	C11-A065
Rokend Zwavelzuur	C11-A157
Root Guard	C11-A051
Rotate	C11-A014
Roter Leu	C11-A098
Rotes Präzipitat	C11-A098
Rotox	C11-A110
RP2300000	C11-A147
RP4200000	C03-D058
RP-Thion	C11-A065
RQ8225000	C11-A057
RTF {DC (50%) and DF (50%) Mixture}	C01-C
RTR-023067	C01-C058
Ruberon	C11-A137
Rubinate TDI	C11-A173
Rubinate TDI	C11-A174

(*Continued*)

Rugby	C11-A031
Ruisaito	C04-A002
Ruisato	C04-A002
Runcol	C03-A005
Ruphos	C11-A061
Russian Thickened VX	C01-A016
Russian V-Gas	C01-A016
Russian VX	C01-A016
RV0540000 {Paraformaldehyde}	C11-A083
RVX	C01-A016
- S -	
(S)-alpha-Cyano-3-phenoxybenzyl (1 R)-cis-3-(2,2-Dibromovinyl)-2,2-dimethylcyclopropanecarboxylate	C11-A049
(S)-alpha-Cyano-3-phenoxybenzyl (1 R,3 R)-3-(2,2-Dibromovinyl)-2,2-dimethylcyclopropanecarboxylate	C11-A049
(S)-alpha-Cyano-3-phenoxybenzyl (1 R,3 S)-3-(2,2-dibromovinyl)-2,2-dimethylcyclopropanecarboxylate	C11-A049
(S)-Cyano(3-phenoxyphenyl)methyl (1 R,3 R)-3-(2,2-Dibromoethenyl)-2,2-dimethylcyclopropanecarboxylate	C11-A049
(S)-α-Cyano-3-phenoxybenzyl (1 R)-cis-3-(2,2-Dibromovinyl)-2,2-dimethylcyclopropanecarboxylate	C11-A049
(S)-α-Cyano-3-phenoxybenzyl (1 R,3 R)-3-(2,2-Dibromovinyl)-2,2-dimethylcyclopropanecarboxylate	C11-A049
[(S)-Cyano-(3-phenoxyphenyl)methyl] (1 R,3 R)-3-(2,2-Dibromoethenyl)-2,2-dimethylcyclopropane-1-carboxylate	C11-A049
[(S)-Cyano-[3-(phenoxy)phenyl]methyl] (1 R,3 R)-3-(2,2-Dibromoethenyl)-2,2-dimethy	C11-A049
S	C03-A017
S 80	C03-C045
S 276	C11-A062
S Mustard	C03-A001
S-(((1,1-Dimethylethyl)thio)methyl) O,O-Diethyl Phosphorodithioate	C11-A163
S-((2-Methoxy-5-oxo-1,3,4-thia-diazolin-4-yl)methyl)dimethylphosphorothiolothionate	C11-A105
S-((2-Methoxy-5-oxo-Δ2-1,3,4-thiadiazolin-4-yl)methyl) O,O-Dimethylphosphorodithioate	C11-A105
S-([(4-Chlorophenyl)sulfanyl]methyl) O,O-Diethyl Dithiophosphate	C11-A036
S-(2-(Diethylamino)ethyl) O,O-Diethylphosphorothioate	C01-A014
S-(2-(Diethylamino)ethyl)phosphorothioic Acid O,O-Diethyl Ester	C01-A014
S-(2,3-Dihydro-5-methoxy-2-oxo-1,3,4-thiadiazol-3-ylmethyl) O,O-Dimethyl Phosphorodithioate	C11-A105
S-(2-Diethylaminoethyl) O,O-Diethyl Phosphorothioate	C01-A014
S-(2-Diethylaminoethyl) O,O-Diethyl Phosphorothioate Hydrogen Oxalate	C01-A014
S-(2-Diethylaminoethyl) O,O-Diethyl Phosphorothiolate	C01-A014
S-(2-Diisopropylamino)ethyl Methylphosphonothioic Acid	C01-D177
S-(2-Diisopropylaminoethyl) O-Ethyl Methyl Phosphonothiolate	C01-A017
S-(2-Diisopropylaminoethyl)methylphosphonothioate	C01-D177
S-(2-Diisopropylaminoethyl)methylphosphonothioic Acid	C01-D177
S-(2-Dimethylaminoethyl) Hydrogen Methylphosphonthiolate	C01-D178
S-(3,4-Dihydro-4-oxo-1,2,3-benzotriazin-3-ylmethyl) O,O-Dimethyl Phosphorodithioate	C11-A013
S-(3,4-Dihydro-4-oxo-benzo(a)(1,2,3)triazin-3-ylmethyl) O,O-Dimethyl Phosphorodithioate	C11-A013
S-(3,4-Dihydro-4-oxo-benzo[d][1,2,3]triazin-3-ylmethyl) O,O-Dimethyl Phosphorodithioate	C11-A013
S-(3,4-Dihydro-4-oxobenzo[d]-[1,2,3]-triazin-3-ylmethyl)OO-dimethyl-phosphorodithioate	C11-A013
S-(3,4-Dihydro-4-oxobenzo[d]-1,2,3-triazin-3-ylmethyl) Dimethyl Phosphorothiolothionate	C11-A013
S-(3,4-dihydro-4-oxobenzol[d][1,2,3]triazin-3-ylmethyl) O,O-Dimethyl Phosphorodithioate	C11-A013

S-(4-Chlorophenylthio)methyl O,O-Diethyl Phosphorodithioate	C11-A036
S-(4-Chlorophenylthiomethyl)diethyl Phosphorothiolothionate	C11-A036
S-(Diethylaminoethyl) O,O-Diethyl phosphorothiolate	C01-A014
S-(Ethyl)chlorothioformic Acid	C11-A067
S-(tert-Butylthiomethyl)-O,O-diethyldithiophosphat	C11-A163
S,S'-(1,4-Dioxane-2,3-diyl) O,O,O',O'-Tetraethyl Bis(phosphorodithioate)	C11-A061
S,S'-(1,4-Dioxane-2,3-diyl) O,O,O',O'-Tetraethyl Di(phosphorodithioate)	C11-A061
S,S'-1,4-Dioxane-2,3-diyl Bis(O,O-diethyl Phosphorodithioate)	C11-A061
S,S'-1,4-Dioxane-2,3-diyl O,O,O',O'-Tetraethyl Bis(dithiophosphate)	C11-A061
S,S'-1,4-dioxane-2,3-diyl O,O,O',O'-Tetraethyl Diphosphorodithioate	C11-A061
S,S'-1,4-Dioxane-2,3-diyl O,O,O',O'-Tetraethyl Phosphorodithioate	C11-A061
S,S'-Methylen-bis(O,O-diaethyl-dithiophosphat)	C11-A065
S,S'-Methylene Bis(O,O-diethyl phosphorodithioate)	C11-A065
S,S'-Methylene O,O,O',O'-Tetraethyl Di(phosphorodithioate)	C11-A065
S,S'-Methylene O,O,O',O'-Tetraethyl Phosphorodithioate	C11-A065
S,S'-p-Dioxane-2,3-diyl Bis(O,O-diethyl Phosphorodithioate)	C11-A061
S,S-Di-s-butyl O-Ethyl Phosphorodithioate	C11-A031
S,S-Di-sec-butyl O-Ethyl Phosphorodithioate	C11-A031
S-[(1,1-Dimethylethyl)thiomethyl]-O,O-diethyldithiophosphat	C11-A163
S-[(5-Methoxy-2-oxo-1,3,4-thiadiazol-3(2 H)-yl)methyl] O,O-Dimethyl Dithiophosphate	C11-A105
S-[(5-Methoxy-2-oxo-1,3,4-thiadiazol-3(2 H)-yl)methyl] O,O-Dimethyl Phosphorodithioate	C11-A105
S-[(Éthylsulfanyl)méthyl]phosphorodithioate de Diéthyle	C11-A138
S-[(tert-Butylsulfanyl)methyl] O,O-Diethyl Dithiophosphate	C11-A163
S-[[(para-Chlorophenyl)thio]methyl] O,O-Diethyl Phosphorodithioate	C11-A036
S-[[(p-Chlorophenyl)thio]methyl] O,O-Diethyl Phosphorodithioate	C11-A036
S-[2-(Diethylamino)ethyl] O-(2-Methylpropyl) Methylphosphonothioate	C01-A016
S-[2-(Diethylamino)ethyl] O-(2-Methylpropyl) Methylphosphonothiolate	C01-A016
S-[2-(Diethylamino)ethyl] O-Cyclopentyl Methylphosphonothioate	C01-A019
S-[2-(Diethylamino)ethyl] O-Cyclopentyl Methylphosphonothiolate	C01-A019
S-[2-(Diethylamino)ethyl] O-Ethyl Isopropylphosphonothioate	C01-A025
S-[2-(Diethylamino)ethyl] O-Ethyl Isopropylphosphonothiolate	C01-A025
S-[2-(Diethylamino)ethyl] O-Ethyl Methylphosphonothioate	C01-A015
S-[2-(Diethylamino)ethyl] O-Ethyl Methylphosphonothiolate	C01-A015
S-[2-(Diethylamino)ethyl] O-Ethyl Propylphosphonothioate	C01-A026
S-[2-(Diethylamino)ethyl] O-Ethyl Propylphosphonothiolate	C01-A026
S-[2-(Diethylamino)ethyl] O-Isobutyl Methylphosphonothioate	C01-A016
S-[2-(Diethylamino)ethyl] O-Isobutyl Methylphosphonothiolate	C01-A016
S-[2-(Diisopropylamino)ethyl] Hydrogen Methylphosphonothioate	C01-D177
S-[2-(Diisopropylamino)ethyl] O-Ethyl Methylphosphonothioate	C01-A017
S-[2-(Dimethylamino)ethyl] Hydrogen Ethylphosphonothioate	C01-D179
S-[2-(Dimethylamino)ethyl] Hydrogen Methylphosphonothioate	C01-D178
S-[2-(Dimethylamino)ethyl] O-Ethyl Ethylphosphonothioate	C01-A023
S-[2-(Dimethylamino)ethyl] O-Ethyl Ethylphosphonothiolate	C01-A023
S-[2-(Dimethylamino)ethyl] O-Ethyl Methylphosphonothioate	C01-A018
S-[2-(Dimethylamino)ethyl] O-Ethyl Methylphosphonothiolate	C01-A018
S1	C03-A016
S-1	C10-A006
S10	C10-A016
S-10	C10-A001

(*Continued*)

S-14	C11-A058
S-2((2-Diisopropylamino)ethyl) O-Ethyl Methylphosphonothiolate	C01-A017
S-2(2-(Diethylamino)ethyl) O,O-Diethyl Ester Phosphorothioic Acid	C01-A014
S-2-(Ethylthio)ethyl O,O-Diethyl Ester of Phosphorodithioic Acid	C11-A062
S-2,3-Dihidro-5-metoxi-2-oxo-1,3,4-tiadizol-3-ilmetil O,O-Dimetil Fosforoditioat	C11-A105
S-22	C11-A166
S-28	C11-A172
S-2-Dimethylaminoethyl Ethylphosphonothioate	C01-D179
S-2-Metoksy-1,3,4-tiadiazolo-5-on-N-metylo-O,O-dwumetylowy	C11-A105
S-37	C03-C038
S-40	C11-A158
S-79	C01-C061
S-88	C11-A012
S-91	C07-C009
S-97	C11-A156
S6876	C11-A131
SA	C08-A001
Saeure Fluoride	C11-A076
Safsan	C01-C106
Salbei	C11-A126
Salpetersaure	C11-A126
Salpeterzuuroplossingen	C11-A126
Salufer	C01-C106
Salzsäure Wasserfrei	C11-A088
Salzsäuregas	C11-A088
Samtol	C11-A137
Sanaseed	C11-A159
Sanfel EX	C01-C061
Sanhyuum	C11-A069
Sanmicron	C11-A137
Santar	C11-A098
Santobrite	C11-A134
Santophen	C11-A134
Santox	C11-A064
Sapecron	C11-A037
Sarin	C01-A002
Sarin II	C01-A002
Sarolex	C11-A051
Sastid	C01-C061
Sauerstoff Lost	C11-A017
Sauerstoffyperit	C11-A017
Savuava Rikkihappo	C11-A157
SBB056444	C01-C058
SBCF	C11-A027
s-Butyl Carbonochloridate	C11-A027
s-Butyl Chlorocarbonate	C11-A027
s-Butyl Chloroformate	C11-A027
SC 110	C11-A137
SC7500000	C11-A135
Scalibor	C11-A049

Schewefel-LOST	C03-A001
Schradan	C11-A148
Schwefel(IV)-fluorid	C11-A155
Schwefel(VI)-oxid	C11-A156
Schwefeldioxid	C11-A154
Schwefeldioxyd	C11-A154
Schwefelkohlenstoff	C11-A033
Schwefel-Lost	C03-A001
Schwefelsaeureloesungen	C11-A157
Schwefelsäureanhydrid	C11-A156
Schwefelsäuredichlorid	C11-A158
Schwefeltetrafluorid	C11-A155
Schwefeltrioxid	C11-A156
Schwefelwasserstoff	C07-A006
Schwefligsäureanhydrid	C11-A154
Schweifurt Green	C11-A046
Schweinfurt Green	C11-A046
Schweinfurtergrun	C11-A046
Schweinfurtgreen	C11-A046
Schweinfurth Green	C11-A046
Scutl	C11-A137
SD 3562	C11-A056
SD 9228	C11-A106
s-Di(chloromethyl) Ether	C10-A011
s-Dichloroethane	C11-A070
s-Dichloroethyl Ether	C11-A017
S-Diisopropylaminoethyl-O-ethyl Methylphosphonothiolate	C01-A017
s-Dimethylhydrazine	C11-A059
SDMH	C11-A059
Sebufos	C11-A031
Sebuphos	C11-A031
sec-Butyl Carbonochloridate	C11-A027
sec-Butyl Chlorocarbonate	C11-A027
sec-Butyl Chloroformate	C11-A027
secondary-Butyl Carbonochloridate	C11-A027
secondary-Butyl Chlorocarbonate	C11-A027
secondary-Butyl Chloroformate	C11-A027
sec-Propylamine	C01-C100
Security Nutronex	C01-C061
Sedox	C11-A014
Seedox	C11-A014
Seedoxin	C11-A014
Seedtox	C11-A137
Sefril	C01-C061
Seisan	C07-A001
Sekundaeres Amin	C11-A009
Selan	C11-A091
Selane	C11-A091
Seleen(VI)fluoride	C11-A149

(*Continued*)

Seleenhexafluoride	C11-A149
Selen Heksafluorid	C11-A149
Selen Hidrid	C11-A091
Selenhexafluorid	C11-A149
Selenium Anhydride	C11-A091
Selenium Dihydride	C11-A091
Selenium Fluoride	C11-A149
Selenium Heksafluorida	C11-A149
Selenium Hexafluoride	C11-A149
Selenium Hydride	C11-A091
Selenium(VI) Fluoride	C11-A149
Sélényure D'hydrogène	C11-A091
Seleniuro de Hidrógeno	C11-A091
Seleniuro di Idrogeno	C11-A091
Selenovodonična Kiselina	C11-A091
Selenwasserstoff	C11-A091
Selephos	C11-A133
Sendra	C11-A143
Senf Gas	C03-A001
Senfgas	C03-A001
Senfoel	C11-A007
Sepizin M	C11-A013
Septox	C11-A050
Sesquimustard	C03-A002
Sesquimustard Q	C03-A002
Sesqui-yperite	C03-A002
S-Ethyl Carbonochloridothioate	C11-A067
S-Ethyl Chloridothiocarbonate	C11-A067
S-Ethyl Chloromethanethioate	C11-A067
S-Ethyl Chlorothiocarbonate	C11-A067
S-Ethyl Chlorothioformate	C11-A067
S-Ethyl Chlorothioformic Acid	C11-A067
S-Ethyl Chlorothiol Formate	C11-A067
S-Ethyl Thiochloroformate	C11-A067
S-Ethylene Dimercaptan	C03-D048
Setrete	C11-A137
Sewer Gas	C07-A006
Seymezal	C01-C061
SF	C10-A004
SFA	C11-A152
S-GB	C01-A002
SH {Sulfur Trioxide (90%) and Hydrochloric Acid (10%) Mixture}	C11-A156
Shimmerex	C11-A137
Shreesul	C01-C061
Sialan	C11-A063
Siarki Chlorek	C03-C038
Siarki Dwutlenek	C11-A154
Siarkol Extra	C01-C061
Siarkowodor	C07-A006
Sickosul	C01-C061

SIC-L	C11-A166
Silane, Chloromethyl-	C11-A112
Silane, Dichloro-	C11-A054
Silane, Dichloromethylphenyl-	C11-A121
Silane, Tetrachloro-	C11-A166
Silane, Tetrafluoro-	C11-A150
Silic Clorua	C11-A166
Silic Tetraclorua	C11-A166
Silic(IV) Clorua	C11-A166
Silicijum Tetrafluorid	C11-A150
Silicijum Tetrahlorid	C11-A166
Silicio(tetracloruro di)	C11-A166
Silicium (IV) Fluoride	C11-A150
Silicium(tetrachlorure de)	C11-A166
Siliciumtetrachloride	C11-A166
Siliciumtetrafluoride	C11-A150
Silicon Chloride	C11-A166
Silicon Chloride Hydride	C11-A054
Silicon Fluoride	C11-A150
Silicon Sodium Fluoride	C01-C106
Silicon Tetrachloride	C11-A166
Silicon Tetrafluoride	C11-A150
Silicon(IV) Chloride	C11-A166
Silikon (IV) Klorida	C11-A166
Silikon Tetrafluorida	C11-A150
Silikon Tetraklorida	C11-A166
Siliziumtetrachlorid	C11-A166
Sinafid M 48	C11-A120
Sinalost	C03-A018
Sinituho	C11-A134
Sira	C01-C061
Sirnik Fosforecny	C01-C084
Sixty-three Special E.C. Insecticide	C11-A133
SK 100	C03-A018
SK 101	C03-A017
S-Lost	C03-A001
Slow-Fluoride	C01-C077
SM 1	C03-A002
SM6300000	C11-A134
SM6490000	C11-A134
S-Methyl 1-(Dimethylcarbamoyl)-N-[(methylcarbamoyl)oxy]thioformimidate	C11-A147
S-Methyl N-(Methylcarbamoyloxy)thioacetimidate	C11-A107
S-Methyl N-[[(Methylamino)carbonyl]oxy]ethanimidothioate	C11-A107
S-Methyl N',N'-Dimethyl-N-(methylcarbamoyloxy)-1-thio-oxamimidate	C11-A147
S-Methyl-1-(dimethylcarbamoyl)-N-[(methylcarbamoyl)oxy]thioformamidat	C11-A147
SMFA	C11-A152
Sniper	C11-A103
SNP	C11-A133
Sodanit	C11-A151

(*Continued*)

Sodio, Fluoracetato di	C11-A152
Sodium 2-(Diisopropylamino)ethanethiolate, Sodium Ethyl Methylphosphonate, SodiumS-[2-(diisopropylamino)ethyl]methylphosphonothiolate, and Ethanol Mixture	C01-D
Sodium 2-Fluoroacetate	C11-A152
Sodium Arsenic Oxide	C11-A151
Sodium Arsenide	C08-C004
Sodium Arsenite	C11-A151
Sodium Bifluoride	C01-C079
Sodium Cyanide	C07-C009
Sodium Dioxoarsenate	C11-A151
Sodium Ethyl Methylphosphonothiolate	C01-C069
Sodium Fluoacetate	C11-A152
Sodium Fluoacetic Acid	C11-A152
Sodium Fluoracetate	C11-A152
Sodium Fluoride	C01-C077
Sodium Fluoride Hydrofluoride	C01-C079
Sodium Fluoroacetate	C11-A152
Sodium Fluorosilicate	C01-C106
Sodium Fluorure	C01-C077
Sodium Fluosilicate	C01-C106
Sodium Hexafluorosilicate	C01-C106
Sodium Hexafluosilicate	C01-C106
Sodium Hydrogen Difluoride	C01-C079
Sodium Hydrogen Fluoride	C01-C079
Sodium Metaarsenite	C11-A151
Sodium Monofluoride	C01-C077
Sodium Monofluoroacetate	C11-A152
Sodium Monosulfide	C03-C042
Sodium Ortho Arsenite	C11-A151
Sodium Phosphide	C11-A139
Sodium Salt of Hydrocyanic Acid	C07-C009
Sodium Silica Fluoride	C01-C106
Sodium Silicofluoride	C01-C106
Sodium Silicon Fluoride	C01-C106
Sodium Sulfide	C03-C042
Sodium Sulfide Anhydrous	C03-C042
Sodium Sulfide, b	C03-C042
Sodium Sulfide, beta	C03-C042
Sodium Sulfide, β	C03-C042
Sodium Sulfuret	C03-C042
Sodium Sulphide	C03-C042
Sodium;2-fluoroacetate	C11-A152
Sodium;cyanide	C07-C009
Sodium;oxoarsinite	C11-A151
Sofril	C01-C061
Soilbrom	C11-A069
Soilfume	C11-A069
Solfonil Cloruro	C11-A158
Solfuro di Carbonio	C11-A033
Solvigran	C11-A062

Solvirex	C11-A062
Soman	C01-A003
Somonil	C11-A105
Sontox	C11-A134
Soprathion	C11-A065
Soprathion	C11-A133
Sorex Golden Fly Bait	C11-A107
Sour Gas	C07-A006
Spectracide	C11-A051
Sperlox-S	C01-C061
Spersul	C01-C061
Spersul Thiovit	C01-C061
Spertacide	C11-A051
Spirit of Hartshorn	C11-A009
Spirits of Salt	C11-A088
Spoj 1080	C11-A152
Spor-Kil	C11-A137
Spraytop-Graze	C11-A132
s-Propylamine	C01-C100
SRA 3886	C11-A074
SRA 5172	C11-A103
Srolex	C11-A051
ST24048144	C01-C058
Stannic Phosphide	C11-A139
Starfire	C11-A132
Stathion	C11-A133
Stauffer N 2790	C11-A082
Stauffer R 1303	C11-A036
S-t-Butylthiomethyl O,O-Diethyl Phosphorodithioate	C11-A163
Steladone	C11-A037
Sterilizing Gas	C11-A071
Sternite { Dichlorophenylarsine and Dipheynlychloroarsine Mixture}	C04-A
Sternite {Phenyldichloroarsine (60-50%) and Diphenylchloroarsine (40-50%) Mixture}	C04-A
Sternite, MA	C04-A004
S-tert-Butylthiomethyl O,O-Diethyl Phosphorodithioate	C11-A163
s-Tetrabromoethane	C11-A164
s-Tetrachlorethan	C11-A165
s-Tetrachloroethane	C11-A165
Stibaan	C11-A153
Stiban	C11-A153
Stibane	C11-A153
Stibano	C11-A153
Stibin	C11-A153
Stibina	C11-A153
Stibine	C11-A153
Stibium	C11-A153
Stibylene	C11-A153
Stickmonoxyd	C11-A127
Stickoxid	C11-A127

(*Continued*)

Stickstoff Trifluoride	C11-A129
Stickstoff(II)-oxid	C11-A127
Stickstoff(III)-fluorid	C11-A129
Stickstoff(IV)-oxid	C11-A128
Stickstoffdioxid	C11-A128
Stickstofffluorid	C11-A129
Stickstofflost	C03-A018
Stickstofflost (EBEWE)	C03-A017
Stickstoffmonoxid	C11-A127
Stickstoffoxid	C11-A127
Stickstoffperoxid	C11-A128
Stickstoffsenfgas	C03-A018
Stickstofftrifluorid	C11-A129
Stikstof(IV)oxide	C11-A128
Stikstofdioxide	C11-A128
Stikstofdioxyde	C11-A128
Stikstofmonoxide	C11-A127
Stink Damp	C07-A006
Stoff 100	C01-A001
Stoff 146	C01-A002
Stoff Oder	C01-A001
Stoff-Stoff	C10-A016
Strathion	C11-A133
Stricker	C11-A049
Stricnina	C11-A159
Strihnidin-10-on	C11-A159
Strihnin	C11-A159
Striker	C11-A049
Striknin	C11-A159
Striknino	C11-A159
Strontium Phosphide	C11-A139
Struktol SU 109	C01-C061
Strychinos	C11-A159
Strychnidin-10-one	C11-A159
Strychnin	C11-A159
Strychnina	C11-A159
Strychnine	C11-A159
Strychnos	C11-A159
Stryknidin-10-on	C11-A159
Strykniini	C11-A159
Stryknin	C11-A159
Stutox {Zinc Phosphide}	C11-A139
Sublimado Corrosive	C11-A096
Sublimat	C11-A096
Sublimate	C11-A096
Sublimé Corrosive	C11-A096
Substance 33	C01-A016
Substance 35	C01-A002
Substance 55	C01-A003
Substance 84	C01-A036

Substance 100-A	C01-A019
Substance 146	C01-A002
Substance 3393	C02-A050
Substance A-208	C01-A016
Substance A-230	C01-A036
Substance A-232	C01-A037
Substance A-234	C01-A038
Substance A-242	C01-A039
Substance A-262	C01-A040
Substance R-33	C01-A016
Substance R-35	C01-A002
Substance R-43	C04-A002
Substance R-43A	C04-A002
Substance R-47	C03-A018
Substance R-55	C01-A003
Substance R-74	C03-A001
Substance R-84	C01-A036
Substanz 83	C01-A001
Sufos	C11-A125
Sufran	C01-C061
Sul-Cide	C01-C061
Sulem	C11-A096
Sulema	C11-A096
Sulfane	C07-A006
Sulfane	C11-A156
Sulfane, Bis(2-diisopropylaminoethyl)-	C01-D166
Sulfanylidenemethanone	C11-A035
Sulfate de Dimethyle	C03-A009
Sulfate de Dithallium	C11-A171
Sulfate de Methyle	C03-A009
Sulfate de Thallium	C11-A171
Sulfate Dimethylique	C03-A009
Sulfatep	C11-A161
Sulfato de Dimetilo	C03-A009
Sulfato de Tálio(I)	C11-A171
Sulfax A	C01-C061
Sulfenyl Chloride	C03-C039
Sulfer Dioxide	C11-A154
Sulfex	C01-C061
Sulfhidrato de Metilo	C11-A118
Sulfhydrate de Méthyle	C11-A118
Sulfhydrin {Sulfur Trioxide (90%) and Hydrochloric Acid (10%) Mixture}	C11-A156
Sulfidal	C01-C061
Sulfide, 2-Chloroethyl Chloromethyl	C03-A008
Sulfide, Bis(2-chloroethyl)	C03-A001
Sulfide, Bis(2-hydroxyethyl)	C03-C037
Sulfidotrichlorid Fosforecny	C01-C075
Sulfinyl Chloride	C03-C040
Sulfinyl Dichloride	C03-C040

(*Continued*)

Sulflox	C01-C061
Sulfocarbonic Anhydride	C11-A033
Sulfochloride	C11-A045
Sulfoconcentrol	C01-C061
Sulfonal	C03-A001
Sulfone Aldoxycarb	C11-A003
Sulfone, 2-Chloroethyl Vinyl	C03-D052
Sulfone, Bis(2-chloroethyl)	C03-D055
Sulfone, Divinyl-	C03-D049
Sulfonic Acid Monochloride	C11-A045
Sulfonium Methylide	C11-A118
Sulfonly Chloride	C11-A158
Sulfony Chloride	C11-A158
Sulfonyl Chloride	C11-A158
Sulfonyl Dichloride	C11-A158
Sulfonyl Difluoride	C11-A160
Sulfonyl Fluoride	C11-A160
Sulfonylchlorid	C11-A158
Sulfonylchloride	C11-A158
Sulfonyylikloridi	C11-A158
Sulforon	C01-C061
Sulfotep	C11-A161
Sulfoxide, 2-Chloroethyl Vinyl	C03-D053
Sulfoxide, Bis(2-chloroethyl)-	C03-D056
Sulfur	C01-C061
Sulfur (I) Chloride	C03-C038
Sulfur (II) Chloride	C03-C039
Sulfur (II) Dichloride	C03-C039
Sulfur and Dimethyl Disulfide Mixture	C01-C062
Sulfur Chloride	C03-C038
Sulfur Chloride	C03-C039
Sulfur Chloride (Di)	C03-C039
Sulfur Chloride Oxide	C03-C040
Sulfur Chloride Oxide	C11-A158
Sulfur Decafluoride	C10-A016
Sulfur Dichloride	C03-C039
Sulfur Dichloride Dioxide	C11-A158
Sulfur Dichloride Oxide	C03-C040
Sulfur Difluoride Dioxide	C11-A160
Sulfur Dihydride	C07-A006
Sulfur Dioksida	C11-A154
Sulfur Dioxide	C11-A154
Sulfur Dioxide Difluoride	C11-A160
Sulfur Ðioxit	C11-A154
Sulfur Fluoride	C10-A016
Sulfur Fluoride	C11-A155
Sulfur Fluoride Oxide	C11-A160
Sulfur Hydride	C07-A006
Sulfur Monochloride	C03-C038
Sulfur Mustard	C03-A001

Sulfur Mustard and Lewisite Mixture	C03-A010
Sulfur Mustard and Nitrogen Mustard 1 Mixture	C03-A
Sulfur Mustard and Nitrogen Mustard 3 Mixture	C03-A
Sulfur Mustard and Oxygen Mustard Mixture	C03-A005
Sulfur Mustard and Sesquimustard Mixture	C03-A004
Sulfur Mustard Disulfide	C03-D
Sulfur Mustard Trisulfide	C03-D057
Sulfur Oxide	C11-A154
Sulfur Oxide	C11-A156
Sulfur Oxide Fluoride	C11-A160
Sulfur Oxychloride	C03-C040
Sulfur Oxychloride	C11-A158
Sulfur Oxyfluoride	C11-A160
Sulfur Pentafluoride	C10-A016
Sulfur Phosphide	C01-C084
Sulfur Subchloride	C03-C038
Sulfur Superoxide	C11-A154
Sulfur Tetrafluoride	C11-A155
Sulfur Trioxide	C11-A156
Sulfur Trioxide Mixture with Sulfuric Acid	C11-A157
Sulfur Trioxit	C11-A156
Sulfur(IV) Fluoride	C11-A155
Sulfurane	C03-D047
Sulfurated Hydrogen	C07-A006
Sulfure D'hydrogene	C07-A006
Sulfure de Carbone	C11-A033
Sulfure de Carbonyle	C11-A035
Sulfureted Hydrogen	C07-A006
Sulfuretted Hydrogen	C07-A006
Sulfuric Acid Chlorohydrin	C11-A045
Sulfuric Acid Fuming	C11-A157
Sulfuric Acid Mixture with Sulfur Trioxide	C11-A157
Sulfuric Acid, Beryllium Salt	C11-A015
Sulfuric Acid, Dimethyl Ester	C03-A009
Sulfuric Acid, Fuming	C11-A157
Sulfuric Acid, Thallium Salt	C11-A171
Sulfuric Acid;sulfur Trioxide	C11-A157
Sulfuric Anhydride	C11-A156
Sulfuric Chloride	C11-A158
Sulfuric Chlorohydrin	C11-A045
Sulfuric Dichloride	C11-A158
Sulfuric Oxychloride	C11-A158
Sulfuric Oxyfluoride	C11-A160
Sulfurila Fluorido	C11-A160
Sulfurilfluorid	C11-A160
Sulfurilhlorid	C11-A158
Sulfuro de Carbonilo	C11-A035
Sulfuro de Mostaza	C03-A001
Sulfurochloridic Acid	C11-A045

(*Continued*)

Sulfurochloridoic Acid	C11-A045
Sulfurous Acid Anhydride	C11-A154
Sulfurous Acid, Cyclic Ester with 1,4,5,6,7,7-Hexachloro-5-norbornene-2,3-dimethanol	C11-A063
Sulfurous Anhydride	C11-A154
Sulfurous Chloride	C03-C040
Sulfurous Dichloride	C03-C040
Sulfurous Oxide	C11-A154
Sulfurous Oxychloride	C03-C040
Sulfuroyl Dichloride	C11-A158
Sulfuryl	C11-A154
Sulfuryl Chlo	C11-A158
Sulfuryl Chloride	C11-A158
Sulfuryl Clorua	C11-A158
Sulfuryl Dichloride	C11-A158
Sulfuryl Difluoride	C11-A160
Sulfuryl Fluoride	C11-A160
Sulfurylchlorid	C11-A158
Sulfurylchloride	C11-A158
Sulfurylchoride	C11-A158
Sulfuryldichlorid	C11-A158
Sulfuryldifluoride	C11-A160
Sulfurylfluoride	C11-A160
Sulfurylklorid	C11-A158
Sulfuryylifluoridi	C11-A160
Sulfuryylikloridi	C11-A158
Sulikol	C01-C061
Sulkol	C01-C061
Sulphenyl Chloride	C03-C039
Sulphinyl Chloride	C03-C040
Sulphocarbonic Anhydride	C11-A033
Sulphonyl	C11-A154
Sulphonyl Chloride	C11-A158
Sulphonylchloride	C11-A158
Sulphos	C11-A133
Sulphotepp	C11-A161
Sulphur (II) Chloride	C03-C039
Sulphur Chloride	C03-C038
Sulphur Chloride	C03-C039
Sulphur Chloride (Di)	C03-C039
Sulphur Dichloride	C03-C039
Sulphur Dioxide	C11-A154
Sulphur Monochloride	C03-C038
Sulphur Mustard	C03-A001
Sulphur Subchloride	C03-C038
Sulphur Tetrafluoride	C11-A155
Sulphur Trioxide	C11-A156
Sulphuret of Carbon	C11-A033
Sulphuric Acid	C11-A157
Sulphuric Acid Dichloride	C11-A158
Sulphuryichloride	C11-A158

Sulphuryl Chloride	C11-A158
Sulphuryl Dichloride	C11-A158
Sulphuryl Difluoride	C11-A160
Sulphuryl Fluoride	C11-A160
Sulphurylchloride	C11-A158
Sulsol	C01-C061
Sultaf	C01-C061
Sulvanite	C10-A010
Sulvenite	C10-A010
Sulvinite	C10-A010
Sulvinite {Ethyl Chlorosulfonate (75%) and Stannic Chloride (25%) Mixture}	C10-A010
Summerlost	C03-A001
Sumpor (IV) Oksid	C11-A154
Sumpor (VI) Oksid	C11-A156
Sumpor Dioksid	C11-A154
Sumpor Tetrafluorid	C11-A155
Sumpor Trioksid	C11-A156
Sumporov Trioksid	C11-A156
Sumporov(VI) Oksid	C11-A156
Suncide	C11-A143
Sunfuran	C11-A032
Super Cosan	C01-C061
Super Six	C01-C061
Superlysoform	C11-A083
Superpalite	C10-A004
Superpalite	C11-A175
Supona	C11-A037
Supone	C11-A037
Supracid	C11-A105
Supracide	C11-A105
Suprathion	C11-A105
Surpalite	C10-A004
Suspend	C11-A049
Susvin	C11-A125
Svaveldioxid	C11-A154
Svaveltrioxid	C11-A156
Svovl	C01-C061
SV-Stoff	C11-A126
SW	C01-C065
Swat	C11-A018
Swaweldioksied	C11-A154
Swedish Green	C11-A046
SWS	C01-C066
SY5600000	C10-A003
SY7525000	C11-A139
Sylvanite	C10-A010
sym-Dibromoethane	C11-A069
sym-Dichloroethane	C11-A070
sym-Dichloroethyl Ether	C11-A017

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sym-Dichloromethyl Ether	C10-A011
sym-Dimethylhydrazine	C11-A059
Symetryczna Dwumetylohydrazyna	C11-A059
Symmetrical Dichloromethyl Ether	C10-A011
Symmetrical Tetrachloroethane	C11-A165
Symmetrical-dimethylhydrazine	C11-A059
SymPyro	C01-A017
sym-Tetrabromoethane	C11-A164
sym-Tetrachlorethane	C11-A165
sym-Tetrachloroethane	C11-A165
Synthetic Mustard Oil	C11-A007
S-Yperite	C03-A001
Systam	C11-A148
Systemox	C11-A050
Systophos	C11-A148
Systox	C11-A050
Sytam	C11-A148
SZ7710000	C01-C085
SZ7925000	C01-C090
SZ9085000	C01-C089
SZ9090000	C01-C057
SZ9120000	C01-C059
Szilícium(IV)-klorid	C11-A166
Szilícium-tetraklorid	C11-A166
Szklarniak	C11-A055
- T -	
(tert-Butylthio)methyl O,O-Diethyl Dithiophosphate	C11-A163
(Trichloromethane)sulfenyl Chloride	C10-A014
(Trichloromethyl)sulfenyl Chloride	C10-A014
T	C03-A003
T01840700	C01-C053
T9	C03-A018
T35	C03-C045
T46	C01-A002
T-47	C11-A133
T83	C01-A001
T114	C01-A002
T144	C01-A002
T150	C07-A003
T155	C07-A001
T300 {Arsenic, Magnesium and Aluminum Mixture}	C08-A
T724	C03-A003
T724	C11-A017
T773	C03-A018
T 1024	C03-A017
T-1123	C02-A051
T-1690	C02-A051
T2104	C01-A001
T2106	C01-A002
T2107	C01-A003

T2139	C01-A005
TA1780000	C01-C094
TA5950000	C11-A082
TA8225000	C01-A005
TA8400000	C01-A002
TA8750000	C01-A003
Taboon A	C01-A001
Tabun	C01-A001
Tabun A {Tabun (80%) and Chlorobenzene (20%) Mixture}	C01-A001
Tabun B {Tabun and Chlorobenzene Mixture}	C01-A001
Tag	C11-A137
Tahmabon	C11-A103
Tali(I) Sunfat	C11-A171
Talijum(I) Sulfat	C11-A171
Talium Sulfat	C11-A171
Talliumsulfaatti	C11-A171
Talliumsulfat	C11-A171
Talstar	C11-A016
Tam	C11-A103
Tamanox	C11-A103
Tamaron	C11-A103
Taredan	C11-A031
Tarene	C11-A037
Task	C11-A055
Tatoo	C11-A014
Tattoo	C11-A014
TB0700000	C11-A075
TB1085000	C01-D169
TB1090000	C01-A017
TB1925000	C11-A064
TB2100000	C01-C066
TB2465000	C01-C093
TB3675000	C11-A074
TB4550000	C01-A001
TB4970000	C11-A103
TB6125000	C01-C082
TB8750000	C11-A037
TBA	C01-C067
TBA	C03-A018
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TC7900000	C01-D175
TCAC	C11-A175
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TD4025000	C11-A058
TD4390000	C01-C160
TD4480000	C01-C160
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Tetraethylguanidine	C01-C108
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Tetra-ethyllood	C11-A168
Tetraethylolovo	C11-A168
Tétraéthylplomb	C11-A168
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Tetraethylplumbium	C11-A168
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Tetraethylpyrofosfat	C11-A167
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Tetrafluorogermane	C11-A084
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Tetrafluorosilana	C11-A150
Tetrafluorosilane	C11-A150
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Tetrafluorsilan	C11-A150
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Tetrakloreten	C11-A136
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Trichloromethane Sulphenyl Chloride	C10-A014
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Trichloromethanesulphenyl Chloride	C10-A014
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Trichloromethyl Chloroformate	C10-A004
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Trichloromethyl Sulfochloride	C10-A014
Trichloromethyl Sulfur Chloride	C10-A014
Trichloromethyl Sulphochloride	C10-A014
Trichloromethyl Sulphur Chloride	C10-A014
Trichloromethyl Thiohypochlorite	C10-A014

Trichloromethylsulfenyl Chloride	C10-A014
Trichloromethylsulphenyl Chloride	C10-A014
Trichloromonofluoromethane	C11-A081
Trichloronate	C11-A075
Trichloronitromethane	C10-A006
trichlorophosphane	C01-C081
Trichlorophosphine	C01-C081
Trichlorophosphine Oxide	C01-C083
Trichlorophosphine Sulfide	C01-C075
Trichlorophosphorous Sulfide	C01-C075
Trichlorophosphorus Oxide	C01-C083
Trichlorovinylarsine	C04-C007
Trichloroyxycnoic Acid Chloranehydride	C11-A175
Trichlorure D'arsenic	C04-C006
Trichlorure de Phosphoryle	C01-C083
Tri-clor	C10-A006
Triclorofluormethane	C11-A081
Tricloremetano	C11-A043
Tricloromethyl Chloroformate	C10-A004
Tricloro-nitro-metano	C10-A006
Tricyclo[3.3.1.1(3,7)]tetraarsoxane	C11-A012
Trideuteroarsine	C08-A001
Tridimethylaminomethane	C11-A178
Triethanolamine	C03-C045
Triethoxyphosphine	C01-C088
Triethoxyphosphine Oxide	C01-D175
Triethyl Phosphate	C01-D175
Triethyl Phosphite	C01-C088
Triethylamine, 1,1'-Dimethyl-	C01-D176
Triethylamine, 2,2,2-Trifluoro-	C03-A024
Triethylamine, 2,2',2"-Trichloro-	C03-A018
Triethylamine, 2,2',2"-Trichloro-	C03-A018
Triethylamine, 2,2',2"-Trichloro-, Hydrochloride	C03-A018
Triethylamine, 2,2',2"-Trichloro-, Monopicrate	C03-A018
Triethylamine, 2,2',2"-Trichloro-, Picrate	C03-A018
Triethylamine, 2,2'''-Dithiobis(1',1"-dimethyl-	C01-D167
Triethylamine, 2,2'-Dichloro-	C03-A016
Triethylamine, 2,2'-Dichloro-, Hydrochloride	C03-A016
Triethylamine, 2,2'-Dichloro-2"-fluoro-	C03-A022
Triethylamine, 2',2''-Dichloro-1,1-dimethyl-	C03-A033
Triethylamine, 2',2''-Dichloro-1-methyl-	C03-A029
Triethylamine, 2-Chloro-1',1"-dimethyl-	C01-C
Triethylamine, 2-Chloro-2',2"-difluoro-	C03-A023
Triethylfosfat	C01-D175
Triethylolamine	C03-C045
Trifluoracetylchlorid	C11-A176
Trifluoramina	C11-A129
Trifluoramine	C11-A129
Trifluorammonia	C11-A129

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Trifluorammoniak	C11-A129
Trifluoramonia	C11-A129
Trifluoramônia	C11-A129
Trifluorazan	C11-A129
Trifluorchlorethylen	C11-A177
Trifluoressigsäurechlorid	C11-A176
Trifluoreto de Nitrogênio	C11-A129
Trifluoridoboron	C11-A022
Trifluoridochlorine	C10-A015
Trifluorikloorieteeni	C11-A177
Trifluor-klóretilén	C11-A177
Trifluoro Boron	C11-A022
Trifluoroacetic Acid Chloride	C11-A176
Trifluoroacetila Klorido	C11-A176
Trifluoroacetyl Chloride	C11-A176
Trifluoroamine	C11-A129
Trifluoroammina	C11-A129
Trifluoroammonia	C11-A129
Trifluoroamonio	C11-A129
Trifluorochlorine	C10-A015
Trifluorochloroethylene	C11-A177
Trifluoro-lambda(3)-chlorane	C10-A015
Trifluoromonochloroethylene	C11-A177
Trifluorovinyl Chloride	C11-A177
Trifluoro-λ3-bromane	C11-A024
Trifluoro-λ3-chlorane	C10-A015
Trifluorure D'azote	C11-A129
Trifluorure de Chlore	C10-A015
Trifluoruro de Nitrógeno	C11-A129
Trifluoruro di Azoto	C11-A129
Triformol	C11-A083
Trigosan	C11-A137
Trihidruro de Antimonio	C11-A153
Trihidruro de Fósforo	C11-A139
Trihloroacetil Hlorid	C11-A175
Trihydridoantimony	C11-A153
Trihydridoarsenic	C08-A001
Trihydridophosphorus	C11-A139
Trihydrogen Phosphide	C11-A139
Trihydroxytriethylamine	C03-C045
Trihydrure D'antimoine	C11-A153
Triidruro di Fosforo	C11-A139
Tri-i-propylphosphite	C01-C164
Triisopropoxyphosphine	C01-C164
Triisopropylphosphite	C01-C164
Triklooriasetyylikloridi	C11-A175
Trillekamin	C03-A018
Trilon	C01-A003
Trilon 46	C01-A002
Trilon 83	C01-A001

Trilon 113	C01-A004
Trilon 144	C01-A002
Trilon 300	C08-A001
Trimagnesium Diarsenide	C08-C
Trimagnesium Diphosphide	C11-A139
Trimethoxyfosfin	C01-C086
Trimethoxyphosphine	C01-C086
Trimethyl Ester of Phosphorous Acid	C01-C086
Trimethyl Phosphite	C01-C086
Trimethyl-[3-(methylcarbamoyloxy)phenyl]azanium, Chloride	C02-A051
Trimethylamine	C11-A178
Trimethylamino	C11-A178
Trimethylene Bis(2-chloroethyl Sulfide)	C03-A014
Trimethylfosfit	C01-C086
Trimethylolpropane Phosphate	C06-A002
Trimethylopropane Phosphate	C06-A002
Trimethylphosphite	C01-C086
Trimethyolpropane Phosphate	C06-A002
Trimetilamin	C11-A178
Trimetilammina	C11-A178
Trimetylamin	C11-A178
Trimetyloamina	C11-A178
Trimetyyliamiini	C11-A178
Trimitan	C03-A018
Trimustine	C03-A018
Trimustine	C03-A018
Trinatriumarsenid	C08-C004
Tri-n-butylamine	C01-C067
Triossido di Zolfo	C11-A156
Trioxid de Sulf	C11-A156
Trióxido de Azufre	C11-A156
Trióxido de Enxofre	C11-A156
Trioxyde de Soufre	C11-A156
Triphosgene	C10-A005
Tripropan-2-yl Phosphite	C01-C164
Tris(2-bromoethyl)amine	C03-A021
Tris(2-Chloroethenyl)arsine	C04-C007
Tris(2-chloroethyl)amine	C03-A018
Tris(2-chloroethyl)amine Hydrochloride	C03-A018
Tris(2-chlorovinyl)arsine	C04-C007
Tris(2-hydroxyethyl)amine	C03-C045
Tris(beta-chloroethyl)amine	C03-A018
Tris(beta-chloroethyl)amine Hydrochloride	C03-A018
Tris(beta-hydroxyethyl)amine	C03-C045
Tris(chloranyl)methane	C11-A043
Tris(ethyl) Phosphate	C01-D175
Tris(fluoranyl)-λ3-bromane	C11-A024
Tris(hydroxyethyl)amine	C03-C045
Tris(β-chloroethyl)amine	C03-A018

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Tris(β-chloroethyl)amine Hydrochloride	C03-A018
Tris(β-hydroxyethyl)amine	C03-C045
Tris[(E)-2-chloroethenyl]arsane	C04-C007
Tris-B-chlorovinylarsine	C04-C007
Tris-β-chlorovinylarsine	C04-C007
Trisodium Trifluoride	C01-C077
Trisulfane, 1,3-Di(2-chloroethyl)-	C03-D057
Trisulfide, Bis(2-chloroethyl)-	C03-D057
Trithene	C11-A177
Trithion	C11-A036
Trithiontylphenol	C11-A036
Tritlenek Siarki	C11-A156
Trizinc Diphosphide {Zinc Phosphide}	C11-A139
Trojchlorek Fosforu	C01-C081
Trola	C03-C045
Trolamine	C03-C045
Trolamine2,2',2"-Nitrilotriethanol	C03-C045
Trona	C11-A019
Trona Boron Trichloride	C11-A020
Trovidur	C11-A180
TS 160	C03-A018
TS6650000	C01-C078
TS8750000	C07-C008
Tsumaphos	C11-A064
TT0700000	C01-C076
Tugon Fliegenkugel	C11-A143
Tungsten Fluoride	C11-A179
Tungsten Hexafluoride	C11-A179
Turcam	C11-A014
TVC	C04-C007
Two Green Rings	C10-A006
Two Red Star (British WWI Cylinder Gas) {Hydrogen Sulfide (90%) and Carbon Disulfide (10%) Mixture}	C07-A006
TX60	C01-A017
TX8750000	C11-A053
TY3700000	C06-A004
TY6475000	C06-A002
TY682500	C06-A003
Typpitrifluoridi	C11-A129
TZ4900000	C11-A095
- U -	
UC8050000	C11-A102
UD1400000	C11-A101
UD1800000	C10-A008
UDVF	C11-A055
UE2275000	C11-A003
Ueberchlorsaeure	C11-A135
UF9625000	C11-A142
UH9800000	C03-A030
Ulphur Dichloride	C03-C039

Ultracide	C11-A105
Ultrasofril	C01-C061
ULV	C11-A050
Ulvair	C11-A125
Undene	C11-A143
Unifos	C11-A055
Unifume	C11-A069
Uniphos	C11-A055
Unisan	C11-A137
Unitox	C11-A037
Unitox	C11-A055
UP	C03-A018
Urea, 1,3-Dicyclohexyl-	C01-D171
US1750000	C11-A008
UX6825000	C11-A167
- V -	
(Vinylsulfonyl)ethene	C03-D049
V Gas (Russian)	C01-A016
V4	C07-A001
Vallantite	C10-A009
Vapona	C11-A055
Vaponite	C11-A055
Vapophos	C11-A133
Vapora II	C11-A055
Vaporole	C11-A009
Vapotone	C11-A167
Vätefosfid	C11-A139
VC	C11-A180
VCM	C11-A180
VCN	C11-A002
VE	C01-A
Vegfru	C11-A138
Vegfru Fosmite	C11-A065
Ventox	C11-A002
Verdasan	C11-A137
Verdican	C11-A055
Verdipor	C11-A055
Verdisol	C11-A055
VG	C01-A014
Vienna Green	C11-A046
Vikane	C11-A160
Villantite	C10-A009
Villiaumite	C01-C077
Vincennite {Hydrogen Cyanide (50%), Arsenic Trichloride (30%), Stannic Chloride (15%) and Chloroform (5%) Mixture}	C07-A
Vincennite Quarternaire	C07-A001
Vinil Hlorid	C11-A180
Vinil Klorür	C11-A180
Vinile (Cloruro di)	C11-A180

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Vinilxlorid	C11-A180
Vinyl 2-Chloroethyl Sulfoxide	C03-D053
Vinyl Alcohol, 2,2-Dichloro-, Dimethyl Phosphate	C11-A055
Vinyl C Monomer	C11-A180
Vinyl Carbinol	C11-A004
Vinyl Chloride	C11-A180
Vinyl Chlorine	C11-A180
Vinyl Clorua	C11-A180
Vinyl Cyanide	C11-A002
Vinyl Sulfide	C03-D051
Vinyl Sulfone	C03-D049
Vinyl Sulfoxide	C03-D050
Vinyl Sulphone	C03-D049
Vinylaceto-beta-lactone	C11-A057
Vinylaceto-β-lactone	C11-A057
Vinylchloride	C11-A180
Vinyle(chlorure de)	C11-A180
Vinylklorid	C11-A180
Vinylkyanid	C11-A002
Vinylofos	C11-A055
Vinylophos	C11-A055
Vinylphate	C11-A037
Vinylsulfonylethene	C03-D049
Vinyphate	C11-A037
Viologen, Methyl-	C11-A132
VIR	C03-A001
Viscous GD	C01-A003
Viscous HD	C03-A001
Viscous HL	C03-A010
Viscous L	C04-A002
Viscous Lewisite	C04-A002
Viscous Mustard	C03-A001
Viscous Soman	C01-A003
Viscous VR	C01-A016
Vitrex	C11-A133
Vitriol Brown Oil	C11-A157
Vitriol, Oil of	C11-A157
Vitrite {Cyanogen Chloride and Arsenic Trichloride Mixture}	C07-A
Vitryte {Cyanogen Chloride and Arsenic Trichloride Mixture}	C07-A
Vivrite {Cyanogen Chloride and Arsenic Trichloride Mixture}	C07-A
VM	C01-A015
VMI 10-3	C11-A008
VN {Hydrogen Cyanide (50%), Arsenic Trichloride (30%), Stannic Chloride (15%) and Chloroform (5%) Mixture}	C07-A
Vodonik Selenid	C11-A091
Vofatox	C11-A120
Volatile Mustard Oil	C11-A007
Volatile Oil of Mustard	C11-A007
Volfram Heksafluorid	C11-A179
Volframi(VI)fluoridi	C11-A179

Volframiheksafluoridi	C11-A179
Volpar	C11-A137
Volphor	C11-A138
Vomiting Gas	C10-A006
Vonfam(VI) Florua	C11-A179
VR	C01-A016
VR-55	C01-A003
VS	C01-A
VS9450000	C11-A149
V-sub-x	C01-A018
VUAgT 1-4	C11-A062
VUAgT 182	C11-A138
VUAgT 1964	C11-A062
VV3050000	C11-A054
VV8410000	C01-C106
VW0525000	C11-A166
VW2327000	C11-A150
VX	C01-A017
Vx	C01-A018
VX (Russian)	C01-A016
VX Disulfide	C01-D167
VX Hydrolysate	C01-D
VX Sulfide	C01-D166
VX2 {Binary}	C01-A017
VXH	C01-D
Vydate	C11-A147
VZ36370	C01-C058
VZ7525000	C07-C009

- W -

W-100174	C11-A105
W-109506	C11-A056
Wacker S 14/10	C11-A058
Walirang Dioksida	C11-A154
Wasserstoffchlorid	C11-A088
Watershed Wood Preservative	C11-A134
Waterstofbromide	C11-A087
Waterstofchloride	C11-A088
Waterstoffosfide	C11-A139
Waterstofperchloraat	C11-A135
Waterstoftetrafluorboraat	C11-A169
WB0350000	C01-C077
WB0350010	C01-C079
WE1905000	C03-C042
Weed and Brush Killer	C11-A134
Weedone	C11-A134
Weeviltox	C11-A033
Wegla Dwusiarczek	C11-A033
Wegla Tlenek	C09-A001
Westron	C11-A165

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Wetsulf	C01-C061
Wettasul	C01-C061
WFNA	C11-A126
White Arsenic	C11-A012
White Fuming Nitric Acid	C11-A126
White No. 1	C04-C006
White Star (British WWI Cylinder Gas) {Phosgene (50%) and Chlorine (50%) Mixture}	C10-A
Winter Mustard	C03-A001
Winterlost	C03-A010
Winterlost {Sulfur Mustard and Phenyldichloroarsine Mixture}	C03-A
Winter-Lost OA {Sulfur Mustard and Arsine Oil Mixture}	C03-A
Winterlost OB	C03-A001
Winterlost OKM {Sulfur Mustard and Dichlorodipropylsulfide Mixture}	C03-A
Winterlost OR	C03-A001
Winylu Chlorek	C11-A180
Wirkstoff 37289	C11-A075
Witophen P	C11-A134
WJ0700000	C11-A153
WL 18236	C11-A107
WL2275000	C11-A159
Wofatox	C11-A120
Wofotox	C11-A120
Wolfraam(VI)fluoride	C11-A179
Wolfraamhexafluoride	C11-A179
Wolfram Hexafluoride	C11-A179
Wolframhexafluorid	C11-A179
Woodtreat A	C11-A134
WQ090000	C03-A001
WQ3250000	C03-A003
WR3325000	C03-D055
WS2100000	C03-D056
WS4250000	C01-C061
WS4300000	C03-C038
WS4480000	C10-A016
WS4550000	C11-A154
WS5600000	C11-A157
WS5605000	C11-A157
WS8225000	C03-A009
WT4800000	C11-A155
WT4830000	C11-A156
WT4870000	C11-A158
WT5075000	C11-A160
Wuerzberg Green	C11-A046
WW2	C01-C072
WY2800000	C11-A162

- X -

X-1	C04-A002
X-3	C04-C007
X1002956-6	C01-D174
X7A0Q688ZP	C01-C079

Xaridium	C01-C077
XG6800000	C11-A171
X-gas	C04-A005
X-gas	C10-A009
X-gas	C10-A011
X-gas	C10-A012
XL1575000	C11-A122
Xloretilen	C11-A180
XLP 30	C11-A055
XM5150000	C03-C040
XN2930000	C01-C075
XN4375000	C11-A161
XR1925000	C11-A172
- Y -	
Y	C03-A001
Y0	C03-A001
Y1	C03-A001
Y2 {Sulfur Mustard thickened with Chlorinated Rubber}	C03-A001
Y3	C03-A005
Y4 (Thickened HT)	C03-A005
Y4a {HT thickened with Polyvinyl Acetate or Polymethyl Methacrylate}	C03-A005
Y4b {HT thickened with Polyvinyl Acetate or Polymethyl Methacrylate}	C03-A005
Y4c {HT thickened with Polyvinyl Acetate or Polymethyl Methacrylate}	C03-A005
Y5 {Sulfur Mustard and Carbon Tetrachloride or Monochlorobenzene Mixture}	C03-A001
Y5a {Sulfur Mustard and Monochlorobenzene Mixture}	C03-A001
Y5b {Sulfur Mustard and Monochlorobenzene Mixture}	C03-A001
Y5c {Sulfur Mustard and Monochlorobenzene Mixture}	C03-A001
Y6 {Thickened Sulfur Mustard and Monochlorobenzene Mixture}	C03-A001
Y7	C04-A002
Y9	C03-A010
Y10 (Thickened HL)	C03-A010
Y13 {Sulfur Mustard and Monochlorobenzene thickened with Chlorinated Rubber}	C03-A001
Y13a {Sulfur Mustard and Benzene Mixture}	C03-A001
Y18 {Sulfur Mustard (50%) and Benzene (50%) thickened with Crepe Rubber (2.6% by weight)}	C03-A001
Y18a {Sulfur Mustard (50%) and Benzene (50%) thickened with Crepe Rubber (3.9% by weight)}	C03-A001
Y25	C03-A001
YA0350000	C01-C067
Yaltox	C11-A032
Yanock	C11-A077
Yasoknock	C11-A152
Yc {Sulfur Mustard and Monochlorobenzene Mixture}	C03-A001
YE1225000	C03-A016
YE1300000	C03-A033
YE1578000	C03-A029
YE2625000	C03-A018
Yellow	C03-A010
Yellow Agents	C03-A
Yellow Agents	C04-A
Yellow Cross (German WWI Shell)	C03-A001

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Yellow Cross 1 (German WWI Shell)	C04-A001
Yellow Cross Agents	C03-A
Yellow Cross Agents	C04-A
Yellow Mercuric Oxide	C11-A098
Yellow No. 2	C04-A002
Yellow Oxide of Mercury	C11-A098
Yellow Precipitate	C11-A098
Yellow Star	C08-A001
Yellow Star (British WWI Cylinder Gas) {Chlorine (70%) and Chloropicrin (30%) Mixture}	C10-A
YH 2	C11-A111
YH 11	C10-A014
YN	C03-A010
YO7720000	C11-A179
Yoduro de Hidrogeno Anhidro	C11-A090
Yperite	C03-A001
Yperite Sulfone	C03-D055
Yperite Sulfoxide	C03-D056
Y-PhDA {Sulfur Mustard and Phenyldichloroarsine Mixture}	C03-A
Yphos	C11-A120
Yt {Sulfur Mustard and Chlorobenzene Mixture}	C03-A001
YZ9800000	C03-D050
- Z -	
(Z)-2-Butenal	C11-A047
(Z)-2-Chlorovinyldichloroarsine	C04-A002
(Z)-But-2-enal	C11-A047
(Z)-Crotonaldehyde	C11-A047
Z	C10-A016
Z-373	C10-A009
Zaclondiscoids	C07-A001
Zahlost (Thickened Sulfur Mustard)	C03-A001
Zahyperit	C03-A001
Zanetti-367 {Phosgene, Chlorine and Stannic Chloride Mixture}	C10-A003
Zaprawa Enolofos	C11-A037
Zaprawa Nasienna Plynna	C11-A119
Zaprawa Nasienna R	C11-A137
Zarin	C01-A002
Z-Chloroethanol	C03-C041
Zelio	C11-A171
ZH1575000	C07-C010
Ziarnik	C11-A137
Zinc Cyanide	C07-C010
Zinc Dicyanide	C07-C010
Zinc Phosphide	C11-A139
Zinctox {Zinc Phosphide}	C11-A139
ZL	C03-A001
ZO	C03-A001
ZOA	C03-A001
Zodiac	C11-A049
Zodrin	C11-A125
Zolvis	C01-C061

Zoman	C01-A003
ZOR	C03-A001
Zorcis	C11-A049
ZT	C04-A002
Zusatz	C10-A003
Zwaveldioxide	C11-A154
Zwavelkoolstof	C11-A033
Zwaveltetrafluoride	C11-A155
Zwaveltrioxide	C11-A156
Zwavelwaterstof	C07-A006
Zwavelzuuranhydride	C11-A156
Zwavelzuuroplossingen	C11-A157
Zwickau Green	C11-A046
Zyklon {Methyl Cyanoformate and Ethyl Cyanoformate Mixture}	C10-A
Zyklon A {Methyl Cyanoformate (90%) and Methyl Chloroformate (10%) Mixture}	C10-A
Zyklon B {Hydrogen Cyanide and Cyanogen Chloride Mixture}	C07-A
Zymafluor	C01-C077
Zytox	C11-A110
1,1,2,2-Тетрахлорэтан	C11-A165
1,1,2-Трифтор-2-хлорэтилен	C11-A177
1,1'-Диметил-4,4'-дипиридилий Дихлорид	C11-A132
1-Изоциано-4-[(4-изоцианофенил)метил] Бензол	C11-A113
2,4-Диизоциано-1-метил-бензол	C11-A173
2,4-ТДИ	C11-A173
2,6-Диизоциано-1-метил-бензол	C11-A174
2,6-ТДИ	C11-A174
3-Хлор-2-метилпроп-1-ен	C11-A102
О-изобутил-S-2-диизопропиламиноэтилметилтиофосфонат	C01-A016
О-этил-S-2-диизопропиламиноэтилметилтиофосфонат	C01-A017
Азот-Моноксид	C11-A127
Азотнокислая Ртуть	C11-A097
Азот-Оксид	C11-A127
Аминометан	C11-A109
Аммиак	C11-A009
Антимонид Водорода	C11-A153
Анхидрид Сумпорасте Киселине	C11-A154
Арсенид Тринатрия	C08-C004
Арсин	C08-A001
Ацетилентетрахлорид	C11-A165
Бис2-Хлорэтилсульфид	C03-A001
Борфтористоводоро́дная Кисло́та	C11-A169
Бром	C10-A002
Бромистий Метил	C11-A110
Бромистый Водород	C11-A087
Бромистый Метил	C11-A110
Бромистый Циан	C07-A002
Бромметан	C11-A110
Бромоводород	C11-A087
Бромометан	C11-A110

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1342422-35-8	C01-C
1342700-45-1	C01-C
1342789-47-2	C01-C
1357848-44-2	C11-A083
1357848-47-5	C03-D060
1357848-57-7	C11-A048
1358624-38-0	C11-A173
1360896-72-5	C01-C106
1361252-19-8	C11-A110
1391413-98-1	C11-A109
1400594-70-8	C11-A113
1414852-51-9	C11-A169
1416946-65-0	C11-A083
1417534-47-4	C11-A118
1417997-02-4	C11-A083
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1447694-91-8	C03-C042
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1519044-64-4	C11-A110
1533423-48-1	C11-A113
1533423-50-5	C11-A048
1538611-90-3	C11-A002
1561105-23-4	C11-A005
1588489-56-8	C11-A113
1609158-91-9	C11-A083
1631149-30-8	C11-A169
1685247-26-0	C08-C004
1794766-48-5	C11-A135
1800084-80-3	C11-A122
1800084-83-6	C11-A095
1976049-23-6	C09-A001
2015239-29-7	C11-A002
2031250-39-0	C11-A113
2041645-24-1	C01-C106
2056146-02-0	C11-A113
2085706-50-7	C01-C106
2093106-90-0	C11-A159
2101638-66-6	C11-A104
2102523-83-9	C11-A135
2108687-60-9	C01-C106
2122854-14-0	C03-D060
2184990-61-0	C11-A135
2192184-31-7	C01-C106

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1005	C11-A009
1008	C11-A022
1016	C09-A001
1017	C10-A001
1026	C07-A005
1032	C01-C098
1036	C11-A068
1040	C11-A071
1045	C11-A076
1048	C11-A087
1050	C11-A088
1051	C07-A001
1052	C11-A089
1053	C07-A006
1061	C11-A109
1062	C11-A110
1064	C11-A118
1067	C11-A128
1076	C10-A003
1076	C10-A004
1079	C11-A154
1082	C11-A177
1083	C11-A178
1086	C11-A180
1093	C11-A002
1098	C11-A004
1131	C11-A033
1135	C03-C041
1143	C11-A047
1154	C01-C097
1158	C01-D174
1182	C11-A066
1184	C11-A070
1185	C11-A072
1221	C01-C100
1235	C11-A109
1238	C11-A111
1239	C11-A044
1243	C11-A115
1244	C11-A116
1259	C09-A003
1340	C01-C084
1350	C01-C061
1360	C11-A139
1385	C03-C042
1397	C11-A139
1419	C11-A139
1432	C11-A139
1433	C11-A139
1541	C11-A001
1545	C11-A007
1559	C11-A011
1560	C04-C006
1561	C11-A012
1575	C07-C007
1580	C10-A006
1585	C11-A046
1589	C07-A003
1595	C03-A009
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1624	C11-A096
1625	C11-A097
1627	C11-A099
1636	C11-A100
1641	C11-A098
1649	C11-A168
1660	C11-A127
1670	C10-A014
1672	C10-A013
1674	C11-A137
1680	C07-C008
1689	C07-C009
1690	C01-C077
1692	C11-A159
1702	C11-A165
1704	C11-A161
1713	C07-C010
1714	C11-A139
1722	C11-A006
1727	C01-C080
1741	C11-A020
1744	C10-A002
1745	C11-A023
1746	C11-A024
1749	C10-A015
1752	C11-A042
1754	C11-A045
1775	C11-A169
1802	C11-A135
1806	C01-C082
1809	C01-C081
1810	C01-C083

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1818	C11-A166
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1828	C03-C039
1830	C11-A157
1831	C11-A157
1834	C11-A158
1836	C03-C040
1837	C01-C075
1838	C11-A172
1859	C11-A150
1873	C11-A135
1888	C11-A043
1889	C07-A002
1892	C04-A001
1897	C11-A136
1911	C11-A052
1916	C11-A017
1921	C11-A145
1994	C09-A002
2011	C11-A139
2012	C11-A139
2013	C11-A139
2025	C11-A073
2027	C11-A151
2032	C11-A126
2078	C11-A173
2186	C11-A088
2188	C08-A001
2189	C11-A054
2191	C11-A160
2194	C11-A149
2195	C11-A162
2196	C11-A179
2197	C11-A090
2198	C11-A140
2199	C11-A139
2202	C11-A091
2204	C11-A035
2213	C11-A083
2232	C11-A040
2249	C10-A011
2262	C02-C052
2284	C11-A095
2323	C01-C088
2329	C01-C086
2334	C11-A005
2357	C11-A048
2382	C11-A059
2401	C11-A141
2404	C11-A142
2407	C11-A093
2417	C11-A034
2418	C11-A155
2420	C11-A086
2431	C11-A010
2437	C11-A121
2439	C01-C079
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2471	C11-A146
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2484	C11-A029
2485	C11-A028
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2521	C11-A057
2534	C11-A112
2542	C01-C067
2548	C11-A039
2554	C11-A102
2570	C11-A030
2629	C11-A152
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2646	C11-A085
2668	C11-A041
2671	C11-A008
2674	C01-C106
2676	C11-A153
2686	C01-C103
2692	C11-A019
2740	C11-A144
2743	C11-A026
2761	C11-A063
2826	C11-A067
2872	C11-A053
2901	C11-A021
3018	C11-A167
3048	C11-A139
3057	C11-A176
3079	C11-A101
3155	C11-A134
3246	C11-A104
3304	C11-A084
9191	C11-A038
9192	C11-A076
9202	C09-A001
9206	C01-C052

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EC	Handbook
200-001-8	C11-A083
200-120-5	C03-A017
200-271-7	C11-A133
200-309-2	C11-A007
200-319-7	C11-A159
200-471-4	C11-A116
200-532-5	C11-A137
200-547-7	C11-A055
200-548-2	C11-A152
200-663-8	C11-A043
200-813-2	C11-A110
200-820-0	C11-A109
200-821-6	C07-A001
200-822-1	C11-A118
200-831-0	C11-A180
200-834-7	C11-A068
200-843-6	C11-A033
200-849-9	C11-A071
200-860-9	C01-C100
200-870-3	C10-A003
200-875-0	C11-A178
200-878-7	C11-A145
200-892-3	C11-A081
200-897-0	C11-A170
200-909-4	C11-A001
200-920-4	C01-C101
200-926-7	C11-A175
200-930-9	C10-A006
201-029-3	C11-A085
201-057-6	C03-D049
201-058-1	C03-A009
201-075-4	C11-A168
201-107-7	C11-A061
201-111-9	C01-C090
201-114-5	C01-D175
201-147-5	C11-A095
201-171-6	C11-A042
201-187-3	C11-A111
201-191-5	C11-A164
201-197-8	C11-A165
201-201-8	C11-A177
201-208-6	C02-C052
201-676-1	C11-A013
201-778-6	C11-A134
201-963-1	C11-A010
202-039-0	C11-A174
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202-966-0	C11-A113
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203-058-7	C01-C067
203-312-7	C03-C043
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203-472-8	C11-A040
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203-481-7	C11-A115
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203-558-5	C01-D174
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203-687-7	C11-A144
203-716-3	C01-C097
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203-874-3	C03-C037
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204-076-8	C11-A058
204-079-4	C11-A063
204-123-2	C11-A003
204-130-0	C01-C165
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204-552-5	C01-C088
204-647-1	C11-A047
204-697-4	C01-C098
204-706-1	C11-A104
204-801-8	C11-A050
204-817-5	C11-A101
204-825-9	C11-A136
205-025-2	C11-A134

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205-379-8	C03-C044
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205-793-9	C11-A072
205-801-0	C11-A148
206-050-1	C11-A120
206-052-2	C11-A138
206-053-8	C11-A050
206-054-3	C11-A062
206-055-9	C01-C073
206-183-5	C11-A059
206-326-1	C11-A075
206-373-8	C11-A051
206-534-2	C11-A034
206-556-2	C11-A176
206-740-2	C11-A079
206-993-9	C03-D047
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207-306-5	C07-A005
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207-347-9	C01-C102
207-348-4	C10-A007
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207-965-9	C10-A004
207-987-9	C11-A008
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208-051-2	C07-A002
208-052-8	C07-A003
208-053-3	C07-A004
208-704-1	C01-C056
208-752-3	C03-D048
208-778-5	C11-A066
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208-840-1	C11-A092
209-134-6	C11-A122
209-162-9	C07-C010
209-242-3	C11-A065
209-251-2	C11-A102
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210-866-3	C11-A117
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211-128-3	C09-A001
211-617-1	C11-A057
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211-634-4	C01-C052
211-636-5	C01-C066
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211-667-4	C01-C089
211-676-3	C11-A086
211-743-7	C01-C058
211-791-9	C04-A004
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212-380-7	C10-A009
212-783-8	C01-C085
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213-408-0	C11-A082
213-449-4	C11-A105
213-600-4	C11-A112
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213-609-3	C01-C164
213-740-6	C06-A002
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216-353-0	C11-A032
216-544-9	C11-A029
217-276-5	C11-A094
217-592-3	C01-C163
217-615-7	C11-A132
217-991-2	C11-A106
218-276-8	C11-A064
218-510-9	C02-C053
219-213-7	C01-D171
220-281-5	C11-A160

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220-633-8	C11-A178
220-916-6	C11-A006
220-928-1	C11-A067
222-995-2	C11-A161
223-622-6	C01-C075
223-888-3	C11-A054
224-030-0	C11-A047
225-141-7	C11-A132
225-195-1	C01-C095
225-399-0	C11-A025
226-045-8	C03-D046
227-204-4	C10-A016
230-042-7	C11-A125
230-392-0	C01-D176
231-152-8	C11-A030
231-195-2	C11-A154
231-197-3	C11-A156
231-201-3	C11-A171
231-299-8	C11-A096
231-441-9	C11-A172
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231-569-5	C11-A022
231-595-7	C11-A088
231-602-3	C11-A140
231-634-8	C11-A089
231-635-3	C11-A009
231-667-8	C01-C077
231-714-2	C11-A126
231-722-6	C01-C061
231-748-8	C03-C040
231-749-3	C01-C081
231-778-1	C10-A002
231-954-8	C11-A076
231-959-5	C10-A001
231-977-3	C07-A006
231-978-9	C11-A091
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232-013-4	C11-A155
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232-027-0	C11-A162
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232-059-5	C04-C006
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232-245-6	C11-A158
232-260-8	C11-A139
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233-046-7	C01-C083
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233-658-4	C11-A020
233-886-4	C11-A099
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234-952-5	C08-C004
235-509-9	C08-C003
235-963-8	C11-A163
236-669-2	C09-A003
236-670-8	C09-A002
236-842-2	C11-A015
237-123-6	C11-A039
237-601-4	C11-A021
240-117-6	C03-D058
240-815-0	C11-A107
240-898-3	C11-A169
240-934-8	C01-C106
241-475-6	C11-A027
242-940-6	C11-A052
244-058-7	C11-A146
244-654-7	C11-A098
244-848-1	C11-A074
245-216-8	C11-A014
245-255-0	C08-C002
245-445-3	C11-A147
247-535-8	C01-D172
250-986-3	C10-A005
258-256-6	C11-A049
277-263-5	C01-C062
601-658-7	C11-A046
608-494-5	C11-A083
616-954-1	C11-A157
619-129-4	C11-A031

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UNII	Handbook
00BH33GNGH	C11-A030
01UQ1KPC7E	C11-A015
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04392RL5SR	C07-C010
04S4K38612	C11-A101
07DFJ2NTDD	C07-C007
09601EZP9R	C11-A066
0DNX22ZOWK	C01-C054
0DZ97C3Z7D	C11-A057
0EX753TYDU	C01-C082
0H3KWS8KJ3	C11-A030
0OU1ESO71L	C11-A140
0T1427205E	C01-C056
0UZA3422Q4	C11-A154
0VKZ97K3UB	C11-A153
10430J81ZZ	C11-A068
117K140075	C10-A003
12Q56Q83EJ	C04-C007
13426ZWT6A	C11-A168
143560H1KL	C03-C044
14ZYO4IKXT	C11-A123
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1L6BI049XV	C11-A165
1MPH591FTG	C11-A115
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1ZYL78UWZN	C09-A003
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265842EWUV	C11-A013
26Q0321ZDG	C01-C086
284SYP0193	C11-A076
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29W4YM10Z	C01-C060
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2JTS8R821G	C11-A049
2KZ83GSS73	C11-A132
2NU89R5398	C11-A034
2O9AXL1TJ4	C11-A045
2RHQ1BS36D	C11-A029
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3L63962IYU	C11-A123
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3UQ7N6O63K	C11-A050
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42GO2PA46L	C11-A130
4402F4X0RH	C11-A129
45B0AG2C4S	C11-A179
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4W5026ZW8G	C03-D050
4Z7627500U	C04-A001
50D9XSG0VR	C03-A017
5138Q19F1X	C11-A009
534Q0F66RK	C07-A005
53GH7MZT1R	C11-A096
54P5FEX9FH	C11-A072
55163IJI47	C11-A070
55228MJ5QM	C11-A075
55I23VY6IE	C11-A122
56V3OG5DC7	C01-C057
5BV6T1107J	C01-C102

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64B59K7U6Q	C11-A160
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